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AWA NETS (EST)

PHONE:
Sun. 7247 kHz SSB, noon (NCS: N4FS)
3867* kHz AM, 7 PM (NCS: W2AN/ICE
Tues. 14274 kHz SSB, 2:30 PM (NCS: varies)
3837* kHz SSB, 8 PM (NCS: N4FS)
Mon.-Wed.-Fri. 3867* kHz, 9:30 AM (NCS: W2AN/W2ICE)
CW: 7050 kHz (NCS varies)
Daily at 4 PM
First Wed. of each month at 8 PM
* Go up 5 kHz if QRM is present.
2-M REPEATER (Rochester area): receive 146.820; transmit 146.220; Mon & Wed., 7:30 PM (NCS: KE2ST or W2ICE)

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FROM THE EDITOR

This issue is a semi-special on vacuum tubes, with tube material totaling ten pages. But we also have three stories on communications receivers, two construction projects, and a good story on aligning a restored receiver - something *every* repaired old set needs. There is coverage on two specialty collecting hobbies: tube cartons, and headsets. Enjoy!

PEARL HARBOR DAY

The Historical Electronics Museum in Baltimore (August OTB, p. 55) observed the 50th anniversary of the Pearl Harbor attack in fine fashion. AWA member Frederick Suffield, early radar engineer, was a speaker. The ceremonies included one-time Private Joseph Lockhart: the radar operator at Opana Point who saw the echoes, bobbing and scintillating above the "grass" on the A-scope of his SCR-270, representing the inbound Japanese bombers. A most fitting commemoration.

COLLECT ATWATER KENT SETS?

Collectors of AK radios (who isn't?) may be particularly interested in Vols. 1, 2, and 3 of the AWA Review. They contain Ralph Williams' three-part, 63-page history of the AK Company and its products, from ignition systems to superhets. There are 78 recent photos by Ralph and by Alan Douglas. All for the price of an AK 35 - and there're the *other* articles in these volumes as well! See page 39 to order.

BETA TRANSISTORS?

A commercial car stereo system is being promoted as having unusual sound clarity because it uses "beta" transistors. Now, *those* are the best kind - sort of like "g_m" tubes, "omega" resistors, or "farad" capacitors. For better performance yet, you can use "mu" transformers and "Q" inductors.

AWA INDEX ON DISC

An index to all AWA publications - OTB, Review, monographs, the Fact Sheet of the old Tube Collector Group - is now available on 5-¼" DOS floppy disc. It requires no special software: just copy it onto a hard drive, then use a word processor to search for a particular phrase. Works great: on a "slow" (AT-style) machine, it finds a reference in 23 seconds or less. We've tried it with Word and Multimate, but any work processor with a "search" feature should work. For a copy, send a self-addressed 5" disc mailer or similar-sized envelope with 75 cents' postage to the editor. We can supply copies on 3-½" disc too. [LAS]

MOTOROLA MUSEUM

As covered on p. 59, the Motorola Museum of Electronics is in business. In an age when large companies tend to clear out their archives and push their origins into oblivion, Motorola is to be commended for having invested heavily in preserving its history.

THE COVER

Tube cartons are eye-catching commercial art, with a bit of history thrown in. For more details, see page 6. *Photo: Studio 1 Photography, Flemington, NJ.*

AWA AWARDS and RECIPIENTS

YEAR	TYNE TUBE	ELLE CRAFTSMAN	THOMPSON	TAYLOR
1980	Patrick Dowd	Alan Douglas		
1981	John Stokes	Robert MacIntyre		
1982	Lauren Peckham	Lincoln Cundall	Ralph Muchow	
1983	William Condon	-	J. & F. Kreuzer	Ken McIntosh
1984	-	Mike Katzdorn	Lauren Peckham	Richard Brewster
1985	-	Ross Smith	Alan Douglas	Edmund Taylor
1986	Alan Douglas	A. C. Stoddard	J. & F. Kreuzer	Stephen Hofer
1987	Rüdiger Walz	-	Michael Payne	Peter Yanczer
1988	Bill Orr	Bob Murray	Floyd Jury	Arnold Chase
1989	-	Billy Richardson	Mike Katzdorn	Pat Leggatt
1990	Gertrude Tyne	Lauren Peckham	Jim McKinnon	
1991	John Anderson	-		

YEAR	CUNDALL OT CONTEST	AWA HOUCK - DOCUMENTATION	AWA HOUCK - PRESERVATION	
1971	W2LV	Thorn Mayes	-	
1972	W2LV	Bruce Kelley	Ed Raser	
1973	W2LV	Gerald Tyne	Robert Merriam	
1974	W2LV/W0TRF	Lou Moreau	Warren Green	
1975	W1DM	William Breniman	Stuart Davis	
1976	W1DM	Howard Schrader	Wayne Nelson	
1977	W1DM	Ralph Williams	Vance Phillips	
1978	K4TS	Don deNeuf	Lauren Peckham	
1979	W1DM	Ivan Coggeshall	Joseph Pavek	MATLACK
1980	W2LV	Lloyd Espenschied	Ralph Muchow	William Shaw
1981	K4TS	Alan Douglas	John Caperton	-
1982	K4TS	-	Fred Hammond	John Haught
1983	W2LV	Kaye Weedon	Patrick Dowd	Bill Hurni
1984	K4TS	Floyd Paul	Rex Matlack	A. C. Stoddard
1985	K4TS	Hugh Aitken	Ralph Williams	-
1986	W8VSK	Bill Fizette	-	James Miller
1987	W2BJI	John Nagle	-	John Rollins
1988	W1YG	Don Patterson	Bob Lozier	John Rollins/Marshall Ett
1989	W2VDI	Bob Morris	Bruce Kelley	Neil Wiegand
1990	W2ER	Morgan McMahon	Charles Dachis	Bob Mattson
1991	W2ER	John Anderson	Bob Paquette	John Rollins/Parker Heinemann

YEAR	DISPLAY	PRESIDENT'S	
1986	Franz Mock/John Glisson	Arlene Roloson	
1987	Max de Henseler	Bruce Kelley	
1988	Bill Fizette	Sherwood Snyder	
1989	Robert Lozier	Helen Kelley	BK-OTB
1990	Jerry & Marsha Simkin	Richard Neidich	Jack Kingman
1991	Floyd Jury	Dexter Deeley	Lloyd Espenschied

Awards are based on these criteria: **Tyne Tube**, honoring Gerald Tyne, for contributions to preserving or documenting the history of tube technology; **Elle Craftsman**, in memory of Bruce Elle, W2VTR, to a builder of high-quality communications equipment of old or new type; **Thompson Best of Show**, in honor of early amateur Eunice Thompson, W1MPP, for an entry in the equipment contest at the Annual Conference; **Cundall Old-Time Contest**, in memory of Lincoln Cundall, W2LC, to the winner of the AWA old-time CW contest; **AWA Houck - Documentation** and - **Preservation**, to remember Harry Houck, radio developer, for achievement in documenting radio development/history or in collecting/-documenting radio artifacts on a noncommercial basis respectively; **Matlack**, via support of Rex Matlack, W3CFC, for excellence in constructing or restoring amateur equipment; **Taylor**, in memory of John Taylor, RCA television developer, for preserving television history; **Display**, for quality and informational value in an exhibit at the equipment contest at the Annual Conference; **President's**: selected by AWA's president, for outstanding service to the Association; **BK-OTB**, via support of Bruce Kelley, W2ICE, for the outstanding original historical article of the award year.

AWA NEWS

CALENDAR

January 29 - "Empire of the Air" airs on PBS
February 19-20, 22-23 - 1992 AWA Old-Time Contest
April 4 - Florida Meet, Bradenton
May 1-2 - IHRS-AWA Annual Meet, Kokomo, IN
May 2 - AWA Spring Meet, Holcomb, NY
May 9 (tentative) - AWA Meet, Tranquility, NJ
May 16 - SCARS/AWA Meet, Torrance, CA
May 29-30 - NARC Radio Daze '92, Bloomington, MN
June 4-6 - ARCA Convention, Pittsburgh
July 10-12 - MARC-AWA
September 23-26 - AWA Annual Conference, Rochester
Nov. 1 - Annual AWA business meeting, Rochester, NY

FLORIDA MEET - BRADENTON

Saturday, April 4

Meet, flea market, program, starting at 8:00 AM, at Stewart Elementary School, 7905 15th Ave., N. W.. For more details, phone Norm Smith, (813) 792-0003, or send an SASE to him at 7203 17th Ave., N. W., Bradenton, FL 34209.

IHRS-AWA ANNUAL REGIONAL MEET

Friday-Saturday, May 1-2

Ramada Inn, Kokomo, IN. Contest and dinner, Friday; auction, Saturday. Programs will be mailed to AWA members in adjacent states. Others may send an SASE to Don/Marilyn Johnston, RR1 Box 218A, Windfall, IN 46076. More details in the May *OTB*. - Ross Smith

NEW YORK SPRING MEET

Saturday, May 2

Local AWA meet, dinner, and clearance sale at the AWA Museum Annex and American Legion Hall, NY 5 & US 20, Holcomb, NY (2 mi. east of the Museum).

9:00 AM - Flea market, until noon.
10:30 AM - Auction of de-accessioned Museum items and miscellaneous orphan equipment at the Annex. Widgets, stuff, boatanchors, useful parts, restoration bait. Everything goes, no minimum!
Noon - Buffet lunch in Legion hall ($6, incl. auction card).
1:00 PM - Appraisal contest, open to members attending lunch.
1:30 PM - Auction of members' equipment. Direct sale, buyer to seller, no minimum. Auction card required ($1 at door) to help defray cost of facilities.

We expect to have the present volumes of the AWA Review, and a full supply of back issues of the *OTB*, available at the meet, so make a list of what you're missing and bring it. Dinner reservations MUST be made before April 27; reservations cannot be accepted at the door. Write or phone now (don't send money): Bruce Kelley, (716) 657-7489, Main St., Holcomb, NY 14469; or Lauren Peckham, (607) 739-5443, RR 1 Box 676, Breesport, NY 14816-9709.

SOUTHERN CALIFORNIA MEET

Saturday, May 16

Meeting at the Velvet Turtle on Sepulveda Blvd. in Torrance; with contest and program. More details in the May *OTB*. - Floyd Paul

SILENT KEYS

(AWA members, amateur licensees or not)

Richard S. Buchholz, W4JNE, long-time participant in the AWA 20-meter Net. (Reported by Seth Ward, KC3YE)
Ed Lewis, WB2PRY
Max Winder

MEET REPORT - GAITHERSBURG

The Gaithersburg (MD) Hamfest took place on Sunday, Sept. 8. I ran the AWA booth as last year and had considerable interest expressed by hundreds of passers-by. My wife Kathy was my main helper, taking care of business while I was looking for "boatanchors." This year we received considerable help from AWA member Paul Mooney, K4KRE. I decided to have a theme this time, so brought out WW II military equipment. I had a large table full of military gear from the USA, Germany, and Japan. We also managed to sign up three new members. - Mike Feher, N4FS

A few AWA members at Gaithersburg.

(Continued on p. 10)

COLLECTING TUBE CARTONS

The cover picture illustrates a charming collecting theme that has become popular in recent years: gathering and displaying tube cartons. These are just plain fun because of their often splashy graphics and colors. They also convey historic insight by giving a glimpse of the commercial forces in the tube market in the old days.

A tube box was a point-of-sale display, often proudly exhibited in the front window of a small radio shop, always visible behind the counter. The smaller manufacturers scrambled to catch the buyer's eye with interesting designs. Thus the "Legion" box had a cutout to display the actual silvery tube, as did others like Champion. Even Western Electric, for its industrial trade, used vivid but conservative cartons.

For the smaller makers, the trade name was an important way to convey an image. Consider "Crusader," "Champion," "Legion," "Defender," or "Marathon" - all symbols of masculine vigor and performance. "Trojan" was obviously the tube for those who practice safe DX. More subtle suggestions of quality were "Gold Seal," "Concert Master," or "Genuine Audion."

The British makers were more diffident - the Brimar, Ferranti, Osram, EverReady, and Marconi package designs were relatively modest even though they too used catchy colors.

A special segment of the market was the house brands like Sears' "WLS" and "Silvertone," Spiegel's "Air Castle," Gamble Stores' "Coronado," or Western Auto's "Wizard." More suspicious were the generic distributor brands with no maker's address on the box: the "Purotron" tube in the photo is unidentified, although close inspection of box and tube hint at regular RCA product. Other unaddressed mystery boxes (not shown here) are "Triangle A" and "Cambridge" - both claiming "purity of tone and long life achieved by advanced engineering." There were "Perma Test," "Reliable," "Tip Top," and "Gammatron" (*not* Heintz & Kaufman!), in a red-and-black design closely mimicking the CBS-Hytron box. There were struggling-but-honest regional distributors in the field, but there were schlockers too. That's why the big brands sealed their boxes with staples during the Thirties.

The cartons hint at tiny manufacturers or distributors in out-of-the-way places: "Vox" came from the Munder Electrical Co. of Springfield, MA; "Marathon" was from Northern Manufacturing Company, site unspecified. Then there were the Legion Laboratories of Lynn, MA; the Par Tube Company of Newton Falls, OH; the Cardon Corporation of Jackson, MI; and so on. These are in addition to the myriad small makers in the Newark-Brooklyn area: firms too small to be known through national advertising.

The display on the cover uses ¼" foam-core poster board, cut with a razor blade and X-Acto knife - easy material to use. Simple wood sides hold it out 1-¼" ahead of a backplate. The foam grips the cartons, letting them slide out for inspection and also allowing placement so that smaller ones stand out the same distance as the large ones. The whole assembly is quite light, yet strong.

To sum it up: these relics make great displays but have historical value as well. - LAS

Some samples from another carton collection, that of Ed Gable, with such names as Stanton, Imperialtron, Alltron, Speed, Van Dyke, Aristocrat, Greylock, Tip-Top, Defender, Stanley, Simplex, Securité, Cetron, Truetone, McMurdo Silver, and Air Castle.

Photo: Ed Gable, K2MP

THE VACUUM TUBE

EDITED BY

BRO. PATRICK DOWD, F.S.C., W2GK

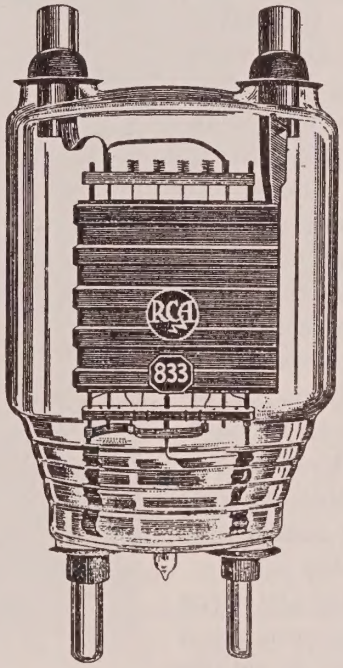
THE 833 STORY

Win Wagener, W6VQD

185-D Towne Rd., Sequim, WA 98382

In 1937, I was asked to develop a tube to compete with the West Coast tantalum-plate tubes. These used cylindrical electrodes and a tantalum plate with no "getter." One counted on some gettering action of tantalum to absorb the gases released during the life of the tube.

Cylindrical electrodes with the filament in a spiral had low perveance (ability to give high plate current with relatively low voltage), due in part to the fact that only one side of the filament wire emitted electrons which could be drawn to the plate. Also, they followed conventional tube design, based on obtaining low inter-electrode capacitance by supporting the elements on thin or small-diameter supports.



If one wishes to design a power tube that will work well at frequencies as high as possible, it should meet at least the following requirements:

- Electrode spacing should be as small as possible to reduce the time of transit of the electrons from filament to grid, as well as from grid to anode.
- The electrode leads should have as low an inductance as possible. In RF terms, this means a circuit approaching a transmission line with distributed L and C approaching those of the electrodes themselves, and not spindly supports merely to give lower capacitance. This gives the largest amount of circuit outside of the tube, better control of the RF voltage of the electrodes, and a higher Q of the RF circuit itself.

Thus the 833 was designed with leads as short and large as possible to provide the minimum inductance. The electrode design was chosen with a flat filament so that emission from both sides of the filament wire could be used and so give double the perveance for the same spacings. From there it was mainly a mechanical problem, while meeting the thermal and structural requirements of power-tube design.

As far as the tantalum plate was concerned, we soon found that tantalum lacks good gettering action and other getter materials had to be introduced to absorb the gases slowly released into the vacuum. Such gases act on the carbonized thoriated-tungsten filament to remove the carbon and thus give short tube life. The 833 was built with a conventional getter so placed as to not interfere with the electrical characteristics of the inner glass surfaces.

All the later so-called Pacific Coast types use zirconium gettering material to meet the long life requirements of the industry. The marvels of tantalum as a getter are no longer talked about.

RCA introduced the 833 in September 1937 as a VHF tube, intended for, among other things, RF heaters in the 30-MHz range. The plate dissipation was 300 watts, using the tantalum anode described above. In October 1940, the 833A was announced. Using a zirconium-coated plate, the dissipation was uprated to 400 watts. Operating at full power, the plate showed a businesslike orange-red color.

The 833A became familiar to generations of AM broadcast engineers: two tubes in parallel, modulated by two more in push-pull, were used in such stalwart transmitters as the Gates BC-1G and BC-1T. Omitting one of the RF tubes gave a 500-watt transmitter. This layout was good for economizing on tube life: if the RF tubes got a little weak from old age, one moved them down into the modulator and squeezed a few thousand more hours out of them. As late as the 1970s, RCA was promoting 833As for design of new broadcast transmitters, on the basis of low cost per hour.

List price of an 833 in 1937 (in 1937 dollars) was $85. Today an 833A catalogs for $199 (present dollars) - a remarkably constant price over a span of fifty-plus years. - LAS

EARLY EQUIPMENT PROFILE

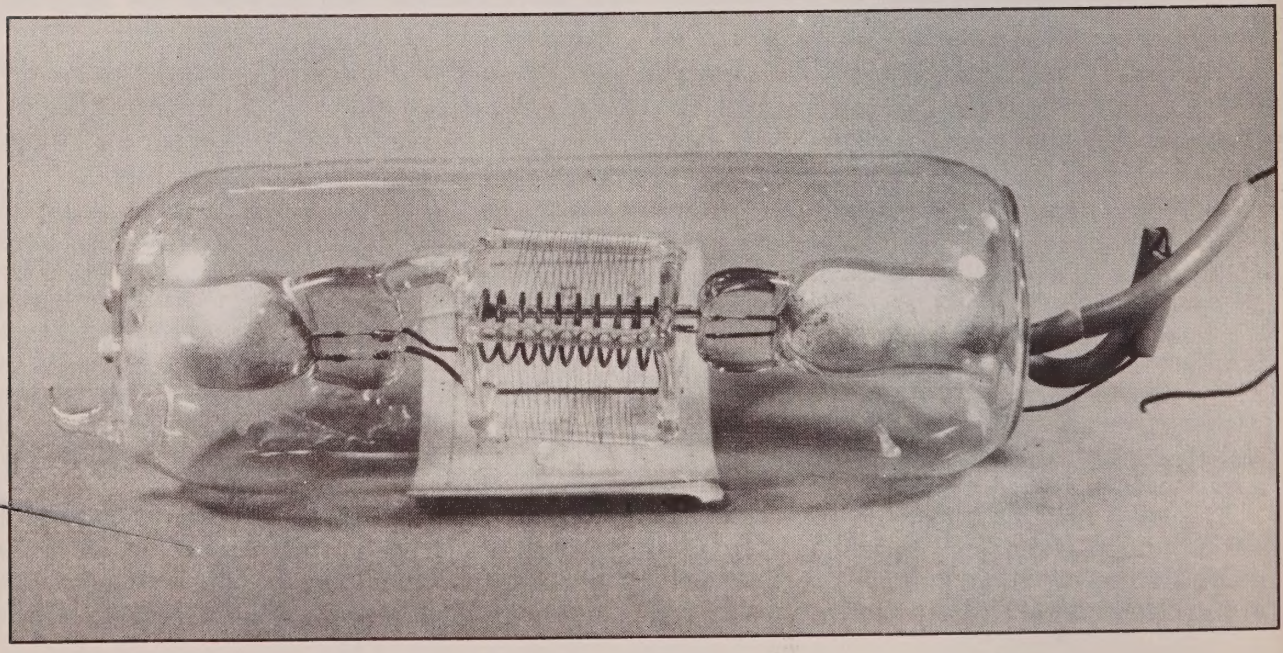
EDITED BY
LAUREN PECKHAM
Ormiston Road, Breesport, N.Y. 14816
All correspondence requires SASE for reply

A PLIOTRON FROM JAPAN?

As early as 1913, the General Electric Company experimented with three-element vacuum tubes. Irving Langmuir and W. C. White were in charge of this program. They devised a special tube using tungsten wire for all parts that might produce gas and thus lower the degree of vacuum.

The tube shown in the photographs was manufactured by the Annaka Wireless Works in Japan. Although the grid is of somewhat heavy construction, the plate consists of very fine wire wound on a hand-formed glass cage. It is safe to assume that the Annaka Company knew about the high-vacuum work carried on at GE before WW I, but the application of this sample is unknown. The label reading "DETECTRON No. 2" and the ink stamp stating "W. V. 50" should mean that the tube was intended for use as a detector. There would be little need for a high plate voltage, which would be possible if the tube were "hard" or highly evacuated. Perhaps a different paper label was used in some cases including information for application as an amplifier. Unfortunately, no electrical test is possible as the envelope is damaged. This might be a good time to mention that even an imperfect sample of a rare tube should be saved, as the interior construction may be observed and possibly identified.

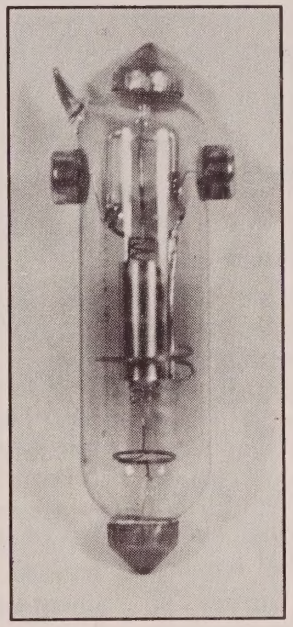
This tube may be compared with the Detectron sample in last February's *OTB*: the envelope is quite similar; the inner construction is entirely different - planar vs. cylindrical.



MAJOR ARMSTRONG AND CAPTAIN ROUND: THE V24 VALVE

M. D. Hall, K2LP
Box 974, Eastham, MA 02642

Edwin Armstrong confided to Jess Haydock, in 1937, that he had been delayed enroute from the U. S. via England to his Army billet in the Paris lab of the Signal Corps during the early stages of the U. S. involvement in World War I, and went by train to London from Southampton. Late that evening he hunted up Capt. Henry Round at the Marconi offices.



Knowing Armstrong's interest in HF amplification, Round showed him a 14-stage HF amplifier they had built to intercept inter-ship transmissions from the German fleet. They figured they might copy information of value from enemy ships operating out of the German naval base at Heligoland, near the western entrance to the Kiel Canal. The Germans were using low-powered buzzer-type transmitters on a "short" wavelength (200 meters/1500 kHz), on the theory that interception or direction finding at a distance was impossible. Not so: as it worked out, the Battle of Jutland resulted from the British DF stations detecting a small change in azimuth, indicating the Germans were about to put to sea.

My recollection was that Round used resistance coupling between these 14 stages and Armstrong said he avoided inter-electrode feedback by providing only a small amount of amplification per stage. Armstrong cited a gain of only 2 but the 14 stages provided a significant amount of overall gain and the receiver developed considerable sensitivity.

Armstrong said he "tampered with one of the tuning controls of the amplifier" and a couple of weeks later received a letter from Capt. Round, recounting that he had spent several hours getting it back into alignment! He also said this example of the monstrous job of getting substantial high-frequency amplification caused him to ruminate about other ways to do the job with the available tubes. The idea occurred of first changing the frequency of the signal to some low value and then amplifying the resulting signal. This became the nucleus of the conception of superheterodyne reception.

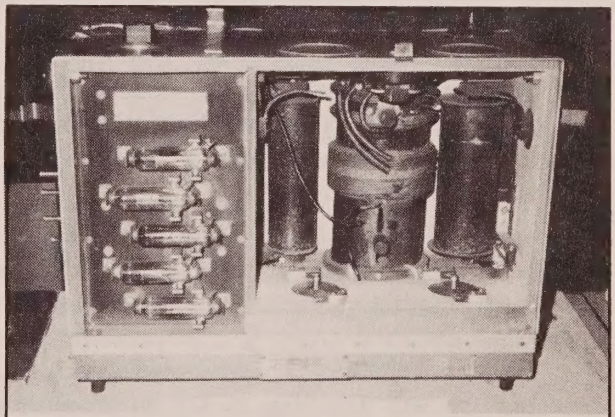
The Marconi V-24 was used in Capt. Round's 14-stage equipment.

The Tyne Saga of the Vacuum Tube (pages 222-227) covers the Marconi V-24 and its detector companion, the "Q" valve, in some detail. Alan Douglas' paper "Who Invented the Superheterodyne?" in The Legacies of Edwin Howard Armstrong (*Proceedings of the Radio Club of America, Inc.*, Vol. 64, No. 3 (Nov. 1990) includes a diagram of one of Round's DF receivers and other details.

The V24 in the photo above is faintly marked "16735 - V.24 - Marconi's W. T. Co. Ltd. - Made in England - Covered by Various Patents." The end caps carry the filament current and are silver-plated for good contact; the side contacts are low-current grid and plate leads and are plain nickel. A dab of green lacquer indicates the plate contact at right. Inside, the grid and plate are supported by a U-shaped glass arbor - labor-intensive and costly construction.

The V24 was famous for having minimal interelectrode capacitance: a measurement on this sample gives a grid-to-plate reading of 2.8 pF, versus 3.7 for a Western Electric VT1 and 5.4 for a General Electric CG-1162. These are for tubes out of the socket. The V24 avoided socket problems by using low-capacitance mounting clips, whereas putting the CG-1162 into a contemporary socket raises the capacitance to 8.5 pF. Tubes of later design were better in this respect than the V24: RCA's 955 (1934) was rated at 1.8 pF, and the 6C4 (1942) at 1.6 pF, but the V24 was a good job for 1916.

The V24 and Q tubes had pure-tungsten high-power filaments (5 V at 750 mA). A receiver with



WW I aircraft radiotelephone, with V24s, in the Marconi Museum at Chelmsford. Set was powered by a wind generator.
All photos: Flemington Signal Depot.

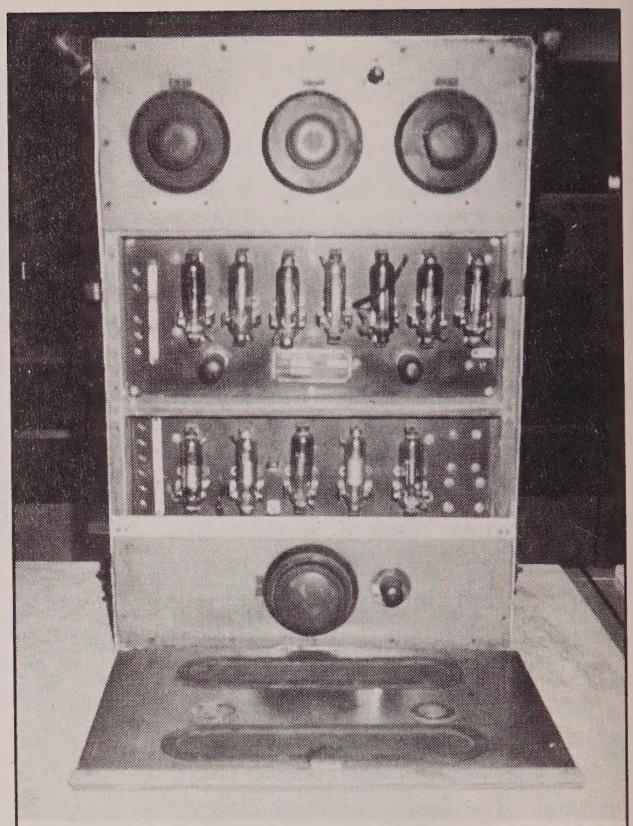
six or eight V24s lined up on the front panel must have been an impressive sight with all those filaments glowing white-hot. Marconi-Osram kept their design into the early Twenties with the "dull emitter" DEV and DEQ, otherwise identical replacements having thoriated filaments (3 V at 200 mA, or 16% as much power). These appeared in a wide variety of shipboard receivers and even home table and console sets - for example, the 1922 three-tube set on p. 65 of Jonathan Hill's Radio!, Radio!.

E. G. Bowen, WW II radar developer, reports in his autobiography Radar Days (Adam Hilger, Bristol, England, 1987) a visit to a Royal Navy submarine in late 1939. The boat had just returned from a combat patrol off the Heligoland Bight. To Bowen's distaste, she had entered WW II with a spark transmitter that had been converted to tube operation in the early Twenties, and a receiver that was "a row of DEQ valves stuck on a long sheet of ebonite." The story was that, when the Admiralty had contracted in the mid-Thirties for a group of additional receivers of existing (obsolete) design, Marconi-Osram was persuaded to reactivate production of the DEQ, which it had long since discontinued.

This story is quite plausible: when the British instituted the Common Valve numbering plan in the early Forties, they assigned the number CV1156 to the DEQ. The tube also carried the number NR18, for Naval Receiving. Technology from 1916 warmed over for WW II.

The V24 must have been available in Canada: an article in the July, 1920 issue of *QST* by the chief engineer of Canadian Marconi reported it had "recently . . been placed on the amateur market with gratifying results."

There were evidently small mechanical changes in V24 production well after the war. The tube depicted in the *QST* article has a simple spiral filament-tension spring at the bottom, unlike the halo-shaped one in the photo above, and lacks the spiral wire (getter?) circling the plate. The version pictured in Tyne's Saga lacks both the tensioning spring and the spiral wire. Marconi-Osram catalog pages from late 1924 show a construction with the spiral wire but only a rudimentary filament spring, whereas those from 1925 depict the style in the photo above. - LAS



WW I airborne radio compass receiver, same museum, with tube cover open. No shortage of V24s!

(Continued from p. 5)

MEET REPORT - VRPS-AWA

The recent joint convention held in Dallas hit an all-time high in attendance and auction results. Bidding on Friday afternoon and Saturday brought record sales of $55,000! Bob Olinger's RCA CT-100 color TV set was first-place winner in one of several contests. AWA provided a technical slide-tape show. - BK

EMPIRE OF THE AIR AVAILABLE

The book Empire of the Air has attracted a good deal of attention - see the review on page 57. AWA has obtained a supply of copies at a substantial discount. To obtain one, send $20 plus $1 for shipping and handling to Dexter Deeley, 8 Briar Circle, Rochester, NY 14618.

BACK ISSUES

The following issues of the *Old Timer's Bulletin* are in stock and orderable via Ludwell Sibley, 44 E. Main St., Flemington, NJ 08822.

Volume and Number

14-4 17-1 18-2 18-3 19-4 21-1 21-2
25-2 25-3 25-4 27-1 27-2

Also, in Vols. 20, 22-24, 26 and 28-32, *all* four numbers of *each* volume are available. Prices are $2.50 each postpaid. Additionally, from Vol. 1 back in 1960, all four numbers xerocopied as a group (34 pages total), $2.50.

Also available are the following monographs at $1.50 each: "The Federal Telegraph Co., 1909-1920" (Thorn Mayes; 13 pp.); "Priority in the Invention of Radio: Tesla vs. Marconi" (Leland Anderson; 9 pp.) and "The RJ-4 Detector and the Wallace Mystery" (Gerald Tyne, 13 pp.). Index to *OTB* Vols. 16-32 and Review Vols. 1-6, free on request with purchase.

Back issues are a moving target: the early ones

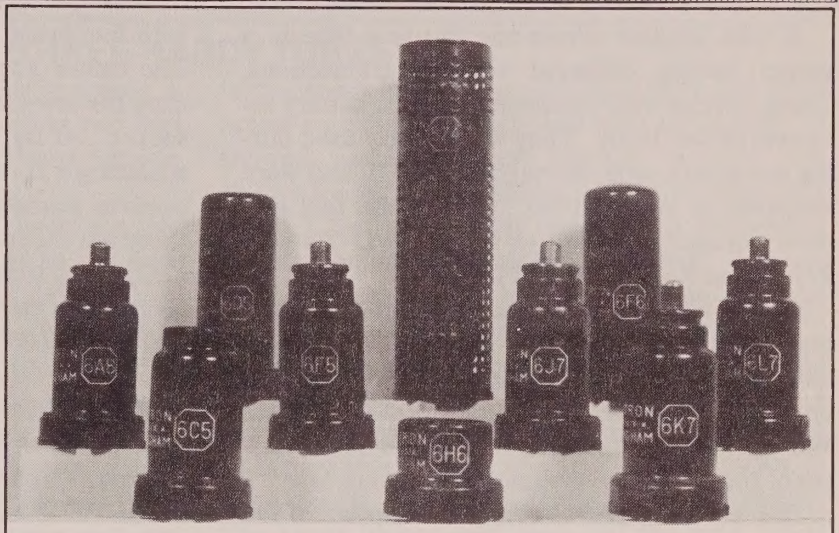
(Continued on p. 23)

THE "ORIGINAL NINE" METAL TUBES AND THE FORGOTTEN 6D5

Ludwell Sibley

The history of the all-metal receiving tube is detailed in Bro. Patrick Dowd's landmark article, "History and Development of the All-Metal Radio Tube," in the *OTB*. It appeared in Vol. 16 No. 4 (Mar. 1976) and Vol. 17 No. 1 (June 1976).

The initial line of these "tin tubes" from RCA, as actually used commercially, contained nine items: the 5Z4 rectifier in a perforated "birdcage" case, five+ inches high; the 6A8 pentagrid converter; the 6C5 triode, in its stepped two-diameter package; the 6F5 top-cap triode; the 6F6 power pentode; the 6H6 duo-diode, in a short flat-topped can; the 6J7 and 6K7 pentodes; and the 6L7 pentagrid mixer. As made before about mid-1936, these had logotypes and other identification steel-stamped into the shells, rather than the familiar ink-stamping. This makes them interesting collectibles - "get the set" - as well as truly correct parts for restoring vintage radios from 1935-36.



The "original nine" (ten). Markings whitened for legibility.

But the composition of the "original nine" depends on what source one uses. The list of electrical characteristics given in the July 1935 issue of *QST* gives all the above units except the 6F5. Instead, it lists the 6D5 power triode. This design had the basic size of the 6F6, carried similar heater and dissipation ratings, but was basically a repackaged 45. When Sylvania announced its second-source metal line (*Sylvania News*, Vol. 5 No. 11, undated but apparently ca. July 1935), its offering included all ten types.

Now, mid-1935 was not a good time to bring out small power triodes. Pentode output tubes were clearly the wave of the future. If one really wanted an audio triode, it was no problem to triode-connect a 6F6. RCA quickly shuffled its line and dropped the 6D5. It vanished so completely that RCA tube literature doesn't mention the 6D5, even as a "discontinued" item. (See, for example, the 1937 RC-13 tube manual. The 1936 ARRL Handbook and 1937 Sylvania Technical Manual also ignore it.)

Sylvania wasted no time pruning its line in 1935, either; Vol. 5 No. 12 of the *Sylvania News* announced the final 6F6-sized version of the 5Z4 and mentioned "nine types now in use"; Vol. 6 No. 2 refers to the 6D5 as "originally announced * * * but withdrawn." A scan of about 7000 tube lineups of radio sets in the 1938 Mallory-Yaxley Radio Servicing Encyclopedia shows not one 6D5. The 6F6, by contrast, was quite popular.

But RCA did make a few of these; the sample in the photo has the original steel-stamped RCA - RADIOTRON - MADE IN U. S. A. - CUNNINGHAM markings. It is shaped like a 6F6 except that the top is slightly dished-in rather than being domed. A pair of 6D5s appears as a modulated oscillator in a "Metal-Tube 5-Meter Transmitter-Receiver" in the 1937 Frank C. Jones Radio Handbook (p. 342). Someone (probably not RCA) registered a 6D5G with the Radio Manufacturers Association in June 1935; someone (*surely* not RCA; maybe Arcturus) registered a metal-glass 6D5MG in July. (To add mystery, the EIA-JEDEC type-number listing of January 1967 indicates that a 6D5 was registered in May, *1941*.)

The steel-stamped tubes were used in the first octal-tube radios. Quite often an Atwater Kent 317, a GE A-75, etc. turns up with some of the original tubes in place. Almost invariably the 5Z4 and 6H6 have been replaced, suggesting poor reliability in the early production. (Birdcage 5Z4s with full emission are rare indeed.) It is most appropriate to refit these sets with all stamped types. A dud birdcage 5Z4 can always be fixed up by putting some silicon diodes and a dropping resistor inside; there's ample room. It is possible to make a rather good simulation of a 5Z4 from a perforated-case octal ballast tube and the same diode-resistor combination. Incidentally, with the original tube a child could stick a thin nail or hairpin through the perforations and contact the 300 volts or so on the bare anodes.

In short: nobody has a problem replacing 6D5s in 1935-36 radios, but collecting a full set of "nine" original tubes really calls for ten items!

TUBE ADAPTERS IN BROADCAST RECEIVERS

Bruce Kelley

A tube adapter allows one to use a tube in a socket having different size or connections. These devices were commonly used in battery receivers of the 1920s. They were widely used during the severe tube shortage of WW II, and were available as late as 1950. One of the first and most popular was used to replace WD-11s with 199s in the Radiola III and IIIA.

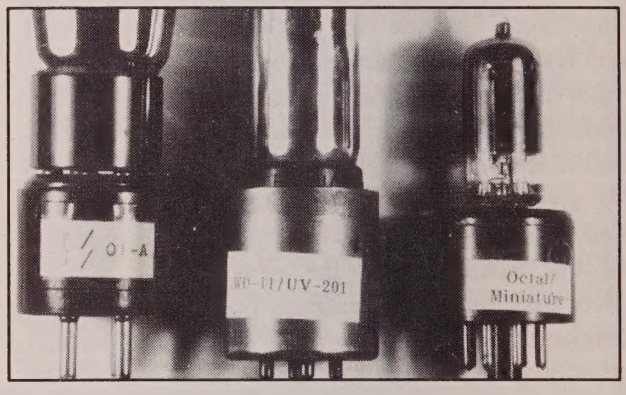
The WD-11 tube was costly, had a delicate filament, and was thus never popular with the set builder. In addition, unlike other tubes, it had one large prong, restricting its socket to only the WD-11. The adapter allowed one to use a variety of tubes with the common four-prong base.

The left photo shows common adapters of the 1920s. Left to right: using a tube with UX base in a UV-199 socket, a UX base in a WD-11 socket, UV-199 tube in a UV socket, and WD-11 in a UX socket.

The second picture, on its left side, shows an adapter to update a battery set of the '20s to "modern" tubes of the '30s, replacing UX-types with five-prong triodes such as the 37, 56, or 76. The center adapter is for where the owner desires the low-filament-drain WD-11 tube in a UV socket. At far right is one of the last adapters - replacing a common octal tube of the '30s with a postwar miniature. Others were marketed, but these are the most common.

Adapters were not necessarily restricted to based types of tubes. Just after WW I, many amateurs placed unmounted tubular tubes (Audiotrons, for example) on improvised four-prong UV bases. They even did this with Audions - one such adapter was in the 1991 Rochester auction. The British likewise mounted their non-based "V24" and "Q" valves in an adapter to fit the popular English four-prong "R" tube socket.

Collecting tube adapters can be a challenge, since not too many were kept. I find the greatest source is old battery receivers such as the Radiola III. My rarest find was a common five-tube battery set with UX-base adapters to accomodate Western Electric 215A peanut tubes.



The MARCONI SCIENTIFIC INSTRUMENT Co. Ltd.,
21/25 ST. ANNE'S COURT, DEAN STREET, SOHO, LONDON, W.

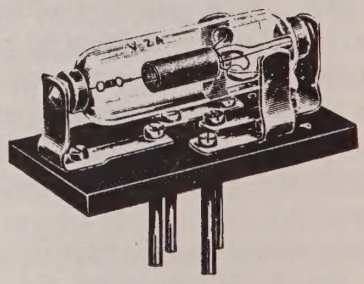
ADAPTORS

FOR USE WITH

"Q" & "V 24"

VALVES

ON EXISTING "R" TYPE HOLDERS



This form of Adaptor is also made as a Plain Holder with Screw-Down Holes, Contact Made Direct to Springs, or under the Ebonite Base with Connecting Nuts.

7/6 POST FREE

MEET THE COLLECTORS

Rodney Schrock, KD3OR
402 Lincoln St., Somerset, PA 15501

THREE HARDY TUBES

Every now and then, I'm sure 'most everyone in this business has come across a tube or two that made him wonder how long it had been outside, exposed to the elements, yet still worked.

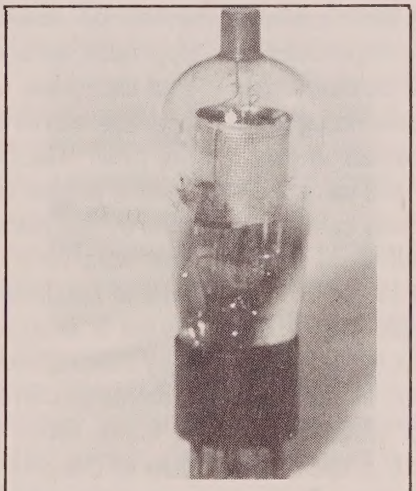
Let me cite some instances. A co-worker told me he was exploring the remains of an old barn across the road from his house and found a "shiny old radio tube" that I could have. Sure enough, it resembled an 01A without any trademark or brand name or type number. The base was badly etched by the elements and the solder in the pins had corroded away, but I cleaned the tube, laid it in the sun for several days to evaporate any moisture inside the base area, soldered the pins, cemented the base to the glass, and tested it. A few quick E_g-I_p tests to measure the transconductance confirmed it was an 01A. I questioned my friend about the possibility of more tubes or a radio. He looked but came up empty-handed.

Another time, I was taking apart a pile of trash in the woods looking for glass insulators and came across an old-style Philco tube with an "S" bulb. It showed some weather damage, notably deterioration of the pin solder. Upon cleaning it, I found I had a 36 which tested good for several minutes before its emission dropped. Judging from a license plate in the pile, I guessed the tube had been outside approximately 30 years.

While patrolling the right of way for a buried fiber-optic cable parallel to the Conrail tracks, I saw something shiny in the snow. Here was an 01A, new-style bulb. It was an RCA, late 1930s, in the remains of an old Echlin condenser tester. The tester looked well used, but the tube, being partly in the case, didn't show any sign of deterioration. After drying it tested "good."

They built them well in the old days. Any tube which laid out in the weather, with its extremes of heat and cold, without the filament opening or elements warping or breaking had to be well made.

If it looks like an 01A and tests like an 01A, it probably *is* an 01A.



A 36 from about '32.

Neither rain nor sleet nor dark of night . . . .

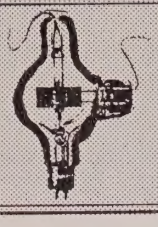
MEET REPORT - BRADENTON, FLORIDA

We had a highly successful meet on December 7. Many members took advantage of the pancake breakfast available at the meet. There were 125 collectors, with an interesting variety of material to buy or swap. There were some really unusual crystal sets, including a rare Amrad which went quickly.

We had three presentations, starting with an informative session by Mark Miner on chassis repair of Thirties cathedrals and tombstones. This was followed by Norm Smith's video presentation "Transistor Radios - A Blast from the Past," which showed over 500 sets and carried a sound track of radio-station jingles, commercials, and songs about transistor radios from the '50s and '60s. Later there was a demonstration of AM stereo.

We had one major success in restoring a collector's interest in radio. One of our attenders came with 55 or 60 sets, wanting to sell them all and get out of the hobby. After attending, he had bought more sets than he sold, reporting "I am really into radio again - none of my sets are for sale!"

We had a good time, seeing radio friends, telling stories about radio subjects, and of course swapping equipment. See page 4 for details on the next meet. - Norm Smith



THE VACUUM TUBE

EDITED BY

BRO. PATRICK DOWD, F.S.C., W2GK

MORE ON THE GAMMATRON

[From a letter from **Jack McCullough**, a founder of Eitel-McCullough, to tube historian Al Jones, K6DIA. Printed by permission. This supplements the Gammatron story in the August 1989 OTB, pp. 19-21, and provides a bit of Eimac history as well.]

. . . Some of the tubes you talk about I do not think were ever sold commercially, probably accounting for the lack of type numbers.

1. The large Gammatron tube you sent me pictures of is of an experimental water-cooled tube Bill [Eitel] and I made while at Heintz & Kaufman. I do not know of any equipment this tube was used in. I believe the plate dissipation rating was to be in the 2- to 5-kW range, but I do not remember if a rating was ever established. There was a barrier that extended down the center of the tube that supported the electrodes. With a special connector, cold water would enter on one side of the barrier and the warm water would leave on the other. The electrodes were made of heliarc-welded stainless steel. The experimental nature of this tube accounts for the lack of a type number. I am unaware of any of these being sold.

2. The only other "gridless" Gammatron that I am aware of was the one made in the same bulb as the 204. It is my recollection it was called HK 155. It was the first tube that Bill Eitel made. The "gridless" Gammatrons shown in the H & K ads other than the HK 255 are unknown to me. The HK 155 was far from a direct replacement for a 204A. First, there was no 204A at this time. The tube was a 204 with a straight tungsten filament. The 204 was a better tube than the Gammatron at the lower frequencies because the grid provided a higher μ and the efficiency was higher because the grid could be driven positive. The 204 lacked total filament emission. It worked much better with 12 volts on the "11-volt" filament! The HK 155 was very low-μ, between 3 and 5. The 204A with larger anode and more efficient thoriated-tungsten filament appeared plus-or-minus 1930. Bill and I left H & K in September 1934. The "gridded" Gammatron tubes, other than the HK 354, were made by the group that took our place at H & K . . . . The receiving-type "gridless" tubes are a mystery to me. I joined H & K in January 1930. Bill Eitel started H & K tube operation a year or two earlier. Whether there were receiving-type tubes built before I came aboard I don't know. I do not remember any discussion about them or seeing any. It is possible that the group running the H & K tube operation after we left had some reason to build these tubes.

A word of explanation about the characteristics of the "gridless" Gammatron will help you understand why these tubes were never very popular. First the μ was very low. The μ was a function of the difference in distance between the filament and "gamma" plate and the distance between the filament and anode. The amount of plate current that could flow was determined by anode-filament spacing. As you know, the tube is placed in series with the load. Ideally, in most applications, it would be desirable to have the tube resistance approach zero ohms at the peak of the positive grid excursion. At this instant all the plate voltage appears across the load, with zero voltage across the tube. The peak plate current that flows at this instant is four or more times the average current read by the plate meter. Obviously no current will flow with zero voltage on the plate. A grid in a tube is maximum positive when the plate voltage across it is at a minimum. Because the grid is very much closer to the cathode that the plate the amount of current that will try to flow to the grid is many times higher than that would normally flow to the plate. What happens in a properly designed tube where the minimum plate voltage is just a little bit higher the positive grid is that most of the current that appears headed for the positive grid is not intercepted by the grid but continues on to the anode. The "gridless" Gammatron does not accelerate the electrons to the anode, so the "gamma" plate excitation voltage is limited to the bias voltage. In the seldom used class "A" service where the tube was biased to some steady-state plate current with the excitation voltage never going positive, the "gridless" Gammatron had some merit. In actual practice it was used as a self-excited oscillator with grid-leak bias. The voltage on the gamma plate often exceeded the RF anode voltage! Crystal controlled oscillators had not come into use yet.

A BRIEF NARRATIVE ON RCA'S LANCASTER PLANT

C. D. Newcomer
100 Central Manor Rd., Mountville, PA, 17554

We probably agree that the camera tube, picture tube and transmitter tube are THE essential components of television. All were the contributions of the Radio Corporation of America plant in Lancaster, Pennsylvania, to the bloom of television following WW II and for the decades that followed. That these important contributions are too seldom recognized was principally the result of an RCA policy that required all tubes, boxes, data sheets, catalogs, application notes, and general advertising to carry only the RCA Harrison Plant address.

From his personal interest, the author offers this narrative in recognition of the historic and commercial contributions of the Lancaster plant.

The Lancaster Plant was built at the onset of WW II to meet critical needs for the engineering and production of special radio and radar tubes and related components essential to the war effort. Funding for the installation was budgeted to the Navy Department. The plant was constructed and facilities installed under the combined direction of the Navy and RCA. Operation of the plant was assigned to RCA.

Through the war years, design, development and award-winning production of power tubes, klystrons, magnetrons, disc-seal triodes and cathode-ray tubes for oscilloscopes and radar displays were achieved at Lancaster. More important to this account, however, were the television accomplishments made during these years.

Both television camera tubes (iconoscopes and image orthicons) and picture tubes (kinescopes) were developed and produced. Military television was born during this period and the world's first television-guided bombs used camera tubes made at Lancaster in cooperation with the RCA laboratories.

After the war, the Navy Department relinquished authority over the plant. Without hesitation, RCA bought the plant and all facilities. Virtually all employees were retained. RCA immediately designated Lancaster to produce the special tubes for television. With this plant, the receiving-tube factory in Harrison, the Camden Plant to produce television cameras and (initially) the receivers, the support of the RCA laboratories, and the facilities of the National Broadcasting Company, RCA was ready to respond to the promise of television promoted during the 1939 World's Fair. The public was anxious for television and RCA was equally anxious to engage in the race that was sure to come.

Camera tubes, picture tubes (kinescopes), VHF transmitter tubes, and even the horizontal-deflection tubes for the receivers were all to be made at Lancaster.

The image-orthicon was key to the success of television. It was the first and only practical camera tube suitable for live broadcast pick-up and was unique to the needs of the time. The image-orthicon was invented by Dr. Vladimir Zworykin of the RCA Laboratories. It was prototyped there and then extensively evaluated at Lancaster, at the Camden camera factory, and in the NBC studios in New York City. The design changes and improvements needed to meet broadcast requirements, commercial needs and full production capabilities were completed at Lancaster and production began. Earliest post-war black-and-white television broadcasts used the image-orthicon and its exclusive use extended well into the epoch of color-television broadcasting. Not all the image-orthicons used throughout the world were produced at Lancaster but there was never an image-orthicon made anywhere without RCA license.

Kinescope production developed in a similar way at Lancaster. The engineering challenge to accommodate the many different sizes and shapes the industry required in ever-increasing quantities was paramount. But the challenge was met and production was achieved to meet the needs in RCA-made receivers and the needs of many other set makers as well. The first million tubes were produced in just a few years of plant operation. This achievement was honored by General Sarnoff and

The sign comes down.
Lancaster New Era photo by Richard Hertzler, used by permission.

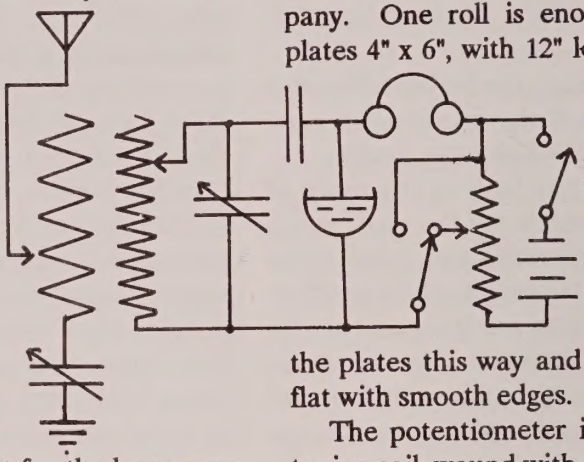
(Continued on p. 51)

A LOOSE-COUPLER CRYSTAL SET

Alan Douglas
Box 225, Pocasset, MA 02559

Few of us can find, let alone afford, factory-built crystal sets like this, but almost anybody can build one that will bring appreciative comments from friends and visitors. You can follow plans closely, or make it any way you please, and who's to say you're wrong? The drawings reproduced here are from Alfred P. Morgan's 1911 Wireless Telegraph Construction for Amateurs.

I took some liberties with Morgan's designs, arranging the parts more symmetrically and eliminating the hollow base that housed the batteries, adding two posts for battery connection instead. I used maple for the baseboard, from an old bed that was handy, but white pine would be a close imitation of the gumwood that most boys had available in 1911. I did use gum (also known as whitewood, poplar, or bass) for most of the remaining wooden parts, as I had some 1/2" thick, just right for the loose-coupler and condenser frames. Morgan recommended cardboard tubing for the coupler primary and a solid wooden cylinder for the secondary. He gave no details for the secondary switch, probably assuming that copper nails would be driven through the end board and the tap wires soldered to the projecting points. What you choose will depend more on what kind of nails or switch points you can get. I bought the 3/16" square brass slider rod through my company purchasing agent from another source, but had to take 12 feet. (I sold the surplus at the AWA annual conference.)

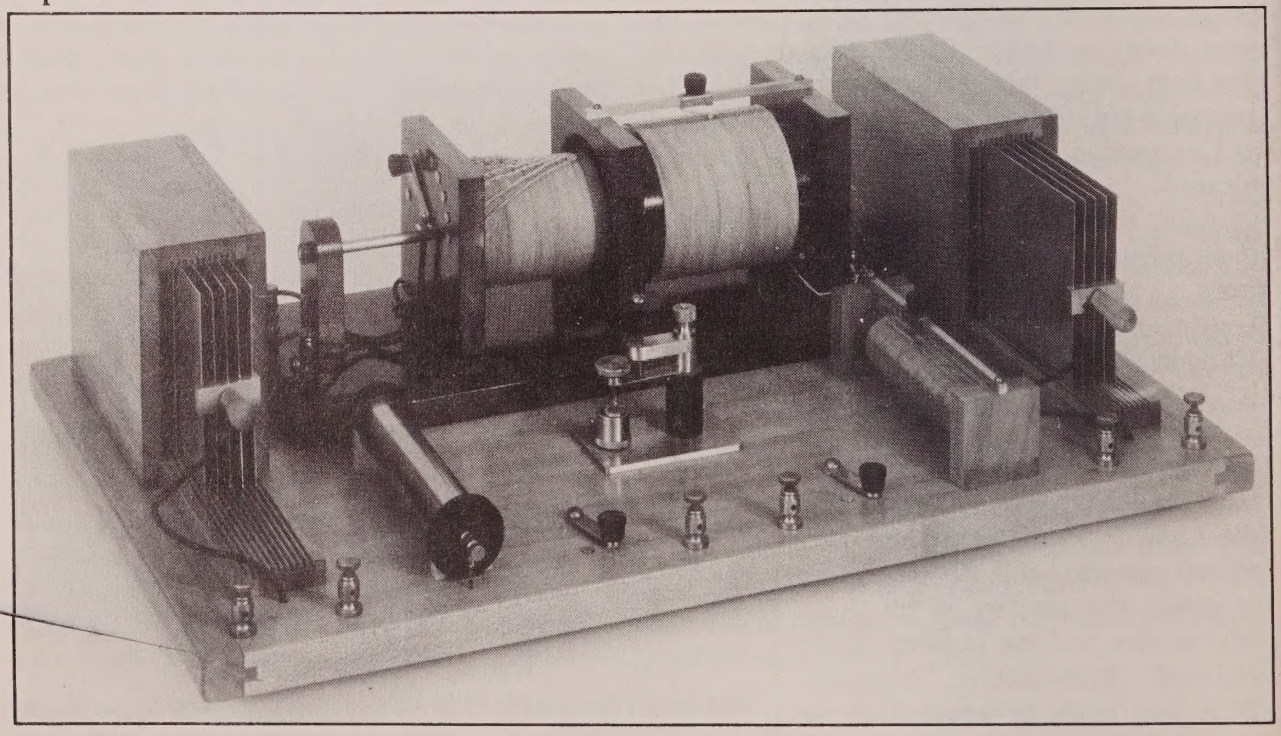


I made the sliding-plate condensers "by the book." Top and bottom boards were grooved with a table saw (a "plywood" blade makes a narrow cut). Plates were cut from .031" shim brass, obtained in a 6" by 100" roll from a tool-supply company. One roll is enough for the required 22 plates 4" x 6", with 12" left over for mistakes. Be sure to straighten the rolled sheet *before* cutting. And don't try cutting it with hand shears or a saw - find a machine shop or sheet-metal shop with a bench shear. It takes only five minutes to cut the plates this way and they come out absolutely flat with smooth edges.

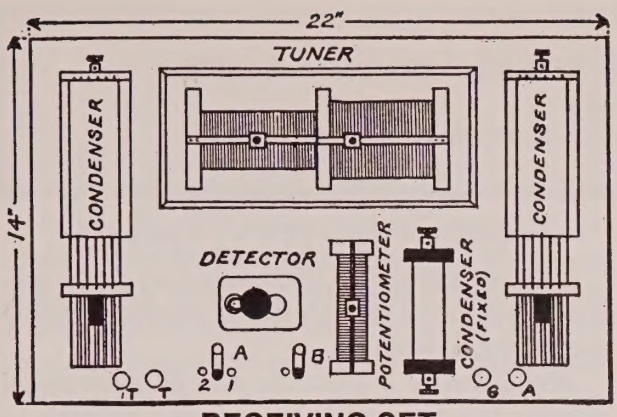
The potentiometer is a miniature single-slide tuning coil, wound with resistance wire.

Morgan's fixed condenser is made of tin foil and waxed paper sheets a few feet long, rolled up and housed in a brass pipe with hard-rubber end plates. I rolled mine around a wooden dowel and threaded the binding posts into the dowel to hold the plates on.

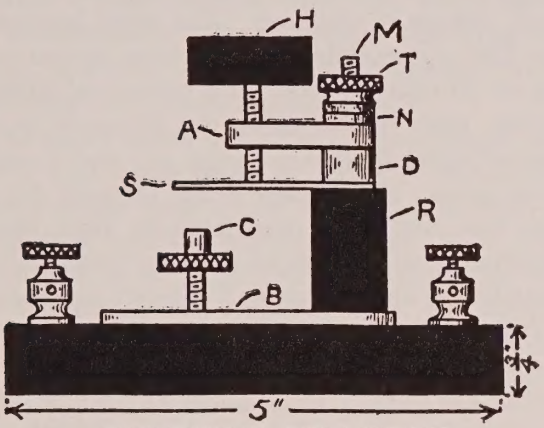
For a finish on the board and components, I used shellac, applying it with a small cotton rag,



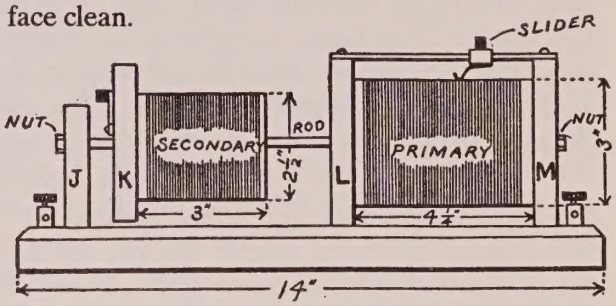
rubbing it in with an occasional dab of raw linseed oil, the technique of French-polishing. I always cut my own shellac by dissolving flakes in alcohol, having had nothing but problems with store-bought shellac. Morgan recommended a waxed finish, beeswax dissolved in turpentine and rubbed in. Also suitable: a penetrating-resin finish, done by applying thinned-out varnish until the wood has soaked up all it can, then wiping the surface clean.



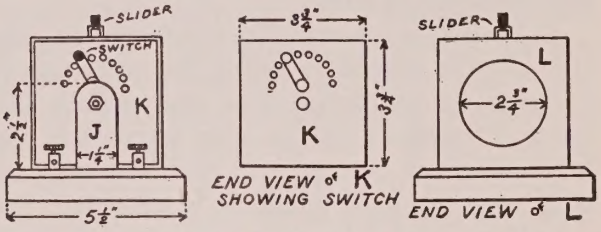
RECEIVING SET



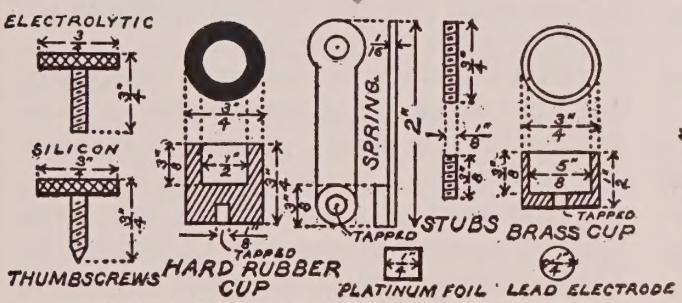
UNIVERSAL DETECTOR



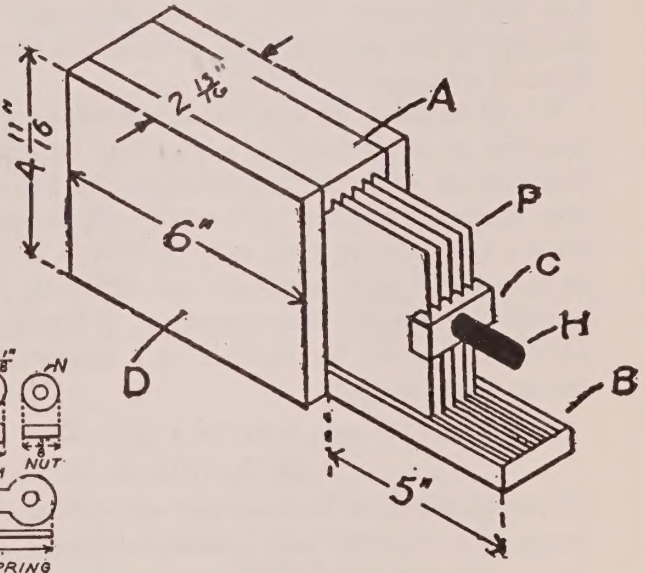
RECEIVING TRANSFORMER



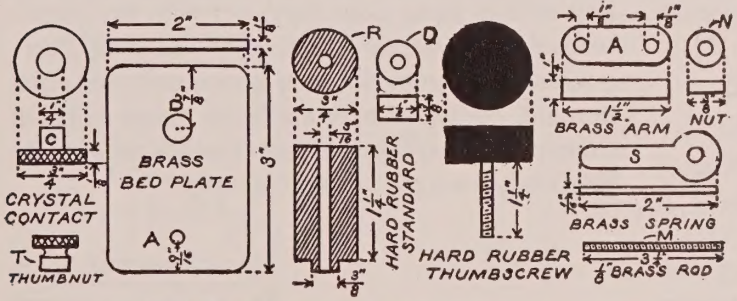
DETAILS OF RECEIVING TRANSFORMER



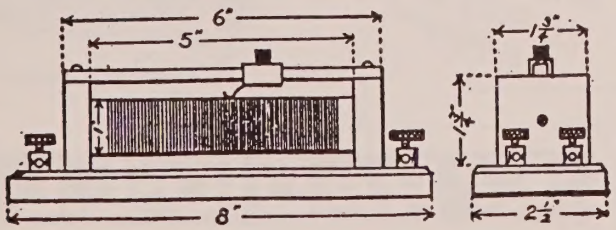
PARTS OF UNIVERSAL DETECTOR



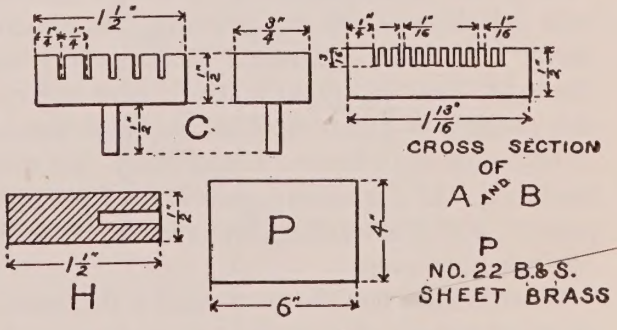
VARIABLE CONDENSER



DETAILS OF DETECTOR



POTENTIOMETER



DETAILS OF VARIABLE CONDENSER

LUCIEN LEVY AND THE SUPERHET: A POSTSCRIPT

Pat Leggatt
Garretts Farm, Pankridge Street, Crondall, Farnham, Surrey, GU10 5QU, England

The AWA Review Volume 6 contained many good things, and I found Dr. Robert Champeix' excellent article on the origins of the superhet most interesting, especially since I had never before heard of Paul Laüt. In particular, he reviews very entertainingly the splendid polemics in the 1925-26 issues of *L'Antenne* magazine. But why should the French have all the fun? May I momentarily revive the *Antenne* controversy here in the pages of the *OTB* by saying that Dr. Champeix seems to have gone astray on one aspect of the theory of amplitude modulation. In view of his notable qualifications and achievements I am hesitant to argue with him on such a matter; but nevertheless here goes!

At the bottom of page 104, continuing on page 105, Lévy is quoted as saying that detection is necessary for generation of an intermediate (difference) frequency, "or, in other words, that the two oscillations that were to beat with one another must act on a nonlinear curve." It is not clear if the words I have put in quotes were written by Lévy or whether they are an interpolation from Dr. Champeix: but in any case the author's footnote on this page certainly declares that nonlinearity is necessary.

It is of course quite true that simultaneous application of two signals to a nonlinear transfer characteristic will result in production of a difference frequency together with other components. If the two signals are A sin ωt_1 and B cos ωt_2, let both be of unity amplitude and called sin X and cos Y to simplify the expressions. If they are added and applied, for example, to a square-law characteristic, we get:

$$(\sin X + \cos Y)^2 = 1 - \tfrac{1}{2}\cos 2X + \tfrac{1}{2}\cos 2Y + \sin (X + Y) + \sin (X - Y).$$

It can be seen that there are sum and difference frequencies, together with second harmonics of the original signals and a DC component. This is known as the "additive" method of frequency conversion and was incorporated in Lévy's process with a leaky-grid detector providing the nonlinearity. The leaky-grid circuit incidentally, given the large signal input that it should have to function properly as a peak rectifier, is a linear detector (although not a linear AF amplifier): but with the fairly small signals envisaged in the Lévy proposals it would be working on the square-law grid-cathode diode curve.

An alternative modulation method is the "multiplicative" system wherein the two original signals are multiplied together. This may be shown:

$$\sin X \cos Y = \tfrac{1}{2}[\sin (X + Y) + \sin (X - Y)]$$

Sum and difference frequencies are again produced, but in this case *there is no requirement for a nonlinear characteristic*.

Multiplicative modulation may be achieved in practice by applying the two signals separately to two grids of a multi-grid tube, be it a tetrode, pentode, hexode or whatever. The signal applied to the first grid modulates the electron stream passing on through the tube. This modulated electron stream then comes under the influence of the second signal applied to a later grid and is modulated again. The current finally reaching the anode has thus been modulated by both signals (equivalent to multiplication of the two) and will include sum and difference frequency components.

Not only is nonlinearity unnecessary, but there is every reason to avoid it by maintaining operation of the mixer tube as linear as possible. Any nonlinearity will result in production of local oscillator harmonics, with the attendant spurious responses which gave rise to Philips' scornful reference to "whistles at every station."

Having argued that nonlinearity is unnecessary, may I end with a sort of denial of this! A multigrid multiplicative mixer is nonlinear in the sense that the final anode current waveform is not a direct representation of either of the input waveforms alone, unless of course one of them is zero. The instantaneous value of the anode current is in fact a function of the amplitudes of both input waveforms, so the slope of the transducer in relation to one input does vary, not with the amplitude of that input, but with the amplitude of the other.

Although he may not have had exactly this point in mind, perhaps I may make my peace with Dr. Champeix by saying that it all depends on what interpretation we put on "nonlinearity."

AN ACTIVE ANTENNA FOR YOUR ANTIQUE RADIOS

D. K. Owens
478 Sycamore Dr., Circleville, OH 43113

Although a few radios had self-contained antennas as far back as 1924, they were the exception. Nearly all sets of the 1920s and early 1930s require a good external antenna for adequate reception. Most of us collectors like to play our receivers from time to time, just to keep the capacitors formed up, but it is not always convenient to provide a good antenna, especially where there are several sets in different rooms. The active antenna described here was put together from junkbox parts to solve that problem.

The figure shows the circuit. It is a simple, untuned wide-band amplifier using a telescoping whip antenna from an old TV set. The whip is coupled to an FET source follower (MPF 102) which acts as an impedance transformer for the self-biased transistor amplifier stage. For the latter, I used a 40235 transistor, which is an RCA device for video amplifier service. A 2N3904 also works, but gives lower gain. I used the 40235 because it had good RF response and was in the junkbox.

All resistors are 1/8 watt and capacitors are small ceramic or Mylar types for printed-circuit application.

L1 and C2 form a wavetrap which is necessary in my area. There is a 1-kW AM transmitter one mile from my house operating on 1540 kHz during the day. Its signal swamps the antenna and must be trapped. You may not need the wavetrap in your area. L1 is 100 μH and C2 is a 50-400 pF compression trimmer. These values are not critical; any combination that will resonate at the frequency of the offending station will do. These values were used because they were available.

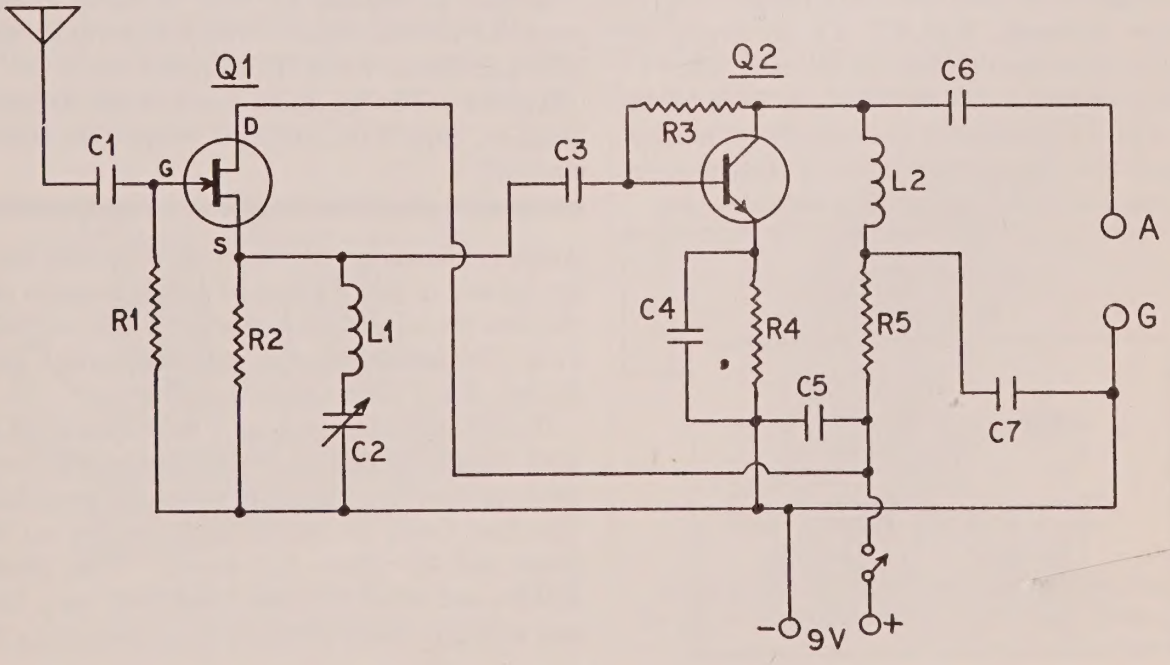
The choke in the output circuit of the transistor stage is there simply for RF isolation, and its value is also not critical. It should not be less than 1 mH, but larger values will work. It is essential that there be a ground connection between the active antenna and the receiver - the active antenna will not work without it.

I will leave the construction details to your ingenuity. My unit is built on a homemade etched circuit board and powered by a nine-volt transistor radio battery. It is housed in a 6" X 3" X 3" box made of ¼" plywood stained dark brown to blend with the radio cabinets. I found it necessary to shield the circuit by lining the plywood box with copper foil connected to the ground bus to keep out the local station. A metal box or a metal-lined plastic box will work as well. If you have no strong local station, you may not need shielding.

Reception with the active antenna is as good as with a 50-foot outdoor long wire at a height of 20 feet.

PARTS LIST

C1 - 100 pF	R3 - 100 K
C2 - See text	R4 - 100 Ω
C3, C6, C7 - 0.01 μF	R5 - 3.3 K
C4 - 0.047 μF	L1 - See text
C5 - 0.22 μF	L2 - 2 mH
R1 - 1 meg	Q1 - MPF 102
R2 - 10 K	Q2 - 40235 or 2N3904



RECENT RADIO AND ENTERTAINER OBITUARIES

Charles Griffen, W1GYR

Andre Baruch, 83, radio-television announcer from the 1930s to early '50s ("The Shadow," "The Kate Smith Hour, "Your Hit Parade"); a founder of the Armed Forces Radio Network during WW II, and announcer on Pathé newsreels.

Art Brown, 92, morning radio host on WOL-WWDC in Washington from 1935 to 1965; previously, a silent-movie organist.

Lt. Col. Richard Bucholz, W4JNE, 74, retired Army officer.

Ed Craney, 86, early broadcaster. In 1922 he built the transmitter in Spokane that went on the air as KFDC (now KXLY). Put KGIR Butte, MT, on the air in 1929; later a chain of stations in Oregon, Washington, and Montana.

Jack Guinan, 74, old-time broadcaster. He worked for WARM and WGBI in Scranton and WKBW in Buffalo in the '30s through '50s. After WW II he joined WTOP in Washington as a baseball announcer and color commentator for the Washington Senators. He retired in 1981 as Public Affairs Officer for NOAA.

Alexander Kendrick, 80, retired correspondent. He was foreign correspondent for CBS in Moscow, London and Vienna and served as London bureau chief.

Robert John Landry, 87, reporter, reviewer, office manager and editor for *Variety*. *Variety's* original radio editor, and was associated with the publication for 50-plus years. In 1942-48 he worked for CBS as Director of Program Writing. He wrote This Fascinating Radio Business and Who, What, Why is Radio.

Kennedy Ludlam, 80, announcer on WRC in Washington from 1940 to the late 1960s.

Bart Molinari, W6AWT, TV developer for Farnsworth in San Francisco in the early '30s.

Edwin McMillan, 83, co-discoverer (with Glenn Seaborg) of plutonium in work on the Manhattan Project; 1951 Nobel Prize winner in chemistry; retired head of the U. C. Lawrence Berkeley Lab.

William Moore, retired technical operator at RCA Communications' Kahuku transoceanic transmitter site in Hawaii.

Homer Odom, 66, radio executive. He was most recently sales manager for KOTA-TV Santa Maria, CA; earlier VP-GM of KABL (AM) Oakland and KABL (FM) San Francisco. One-time owner of KSLY-KUNA San Luis Obispo, CA.

Clifford H. Paul, 71, Chief Engineer, FCC Cable Television Bureau; ex-RCA engineer.

James Reinsch, 82, retired head of Cox Broadcasting and radio-TV-cable pioneer . In 1934 he helped put WHIO on the air and was its GM until 1939. He helped found WSB Atlanta and later was a director of the then-three Cox stations, WLS, WSB and WIOD in Miami. Chairman of Cox, 1939-73.

Everett E. Revercomb, 77, long-term National Association of Broadcasters executive. He began work for NAB in 1935 and served as secretary-treasurer from 1956 to 1976.

Herbert Rice, 86, veteran broadcaster. In 1959 he purchased WILI (AM) Willimantic, CT, and later WINY (AM) Putnam, CT. He built the Nutmeg Broadcasting Co. with additional outlets - WNTY (AM) Southington, CT, and WLIS (AM) Old Saybrook. He retired in 1971 but served as chairman of Nutmeg until his death.

William Rubinstein, 70, pay-TV and cable pioneer. He was associated for many years with International Telemeter Corp., Paramount Pictures' experimental pay-TV business.

Brig. Gen. William Van Harlingen, 74, Signal Corps officer from 1939 to 1969.

Arthur A. Watson, 61, EVP of NBC; former president of NBC Sports. For five years he was EVP and GM of WNBC (TV) New York.

(Thanks to George Ayers, Len Geraldi, Thomas Long, Sr., Seth Ward, and Tina Wiepert for added material).

IN-HOUSE

Bruce Kelley

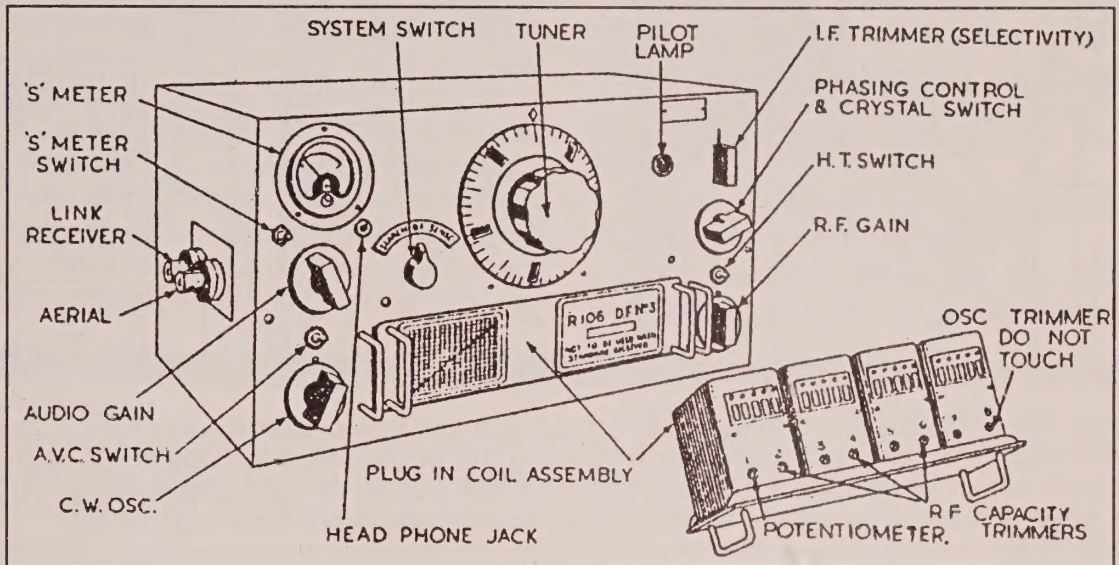
Amateur Networks: Members in the British Isles are invited to join a group of radio amateurs on the first Monday of each month at 0915 on 3640 kHz. Participants discuss early equipment and history. Ray Herbert, G2KU, is NC.

On this subject, how about a West Coast AWA net? KJ6EF would like to see a net in W6-7 territory to discuss old equipment and its operation. The East Coast 40 and 75 SSB nets are out of range and 20 meters too erratic. How about K6DIA and others? If interested, drop me a line and we'll post times in the *OTB*. *(Continued on p. 26)*

THE HRO IN THE BRITISH ARMY

Louis Meulstee, PA0PCR
Smetanalaan 28, 3122 HP Schiedam, Holland

INTRODUCTION. In the Second World War a considerable number of National HRO receivers were purchased from the USA by the British War Office. They were initially used as a stop-gap measure until sufficient numbers of similar British-manufactured receivers were available. However, HROs were to be used throughout the war in applications ranging from clandestine communications to direction finding.



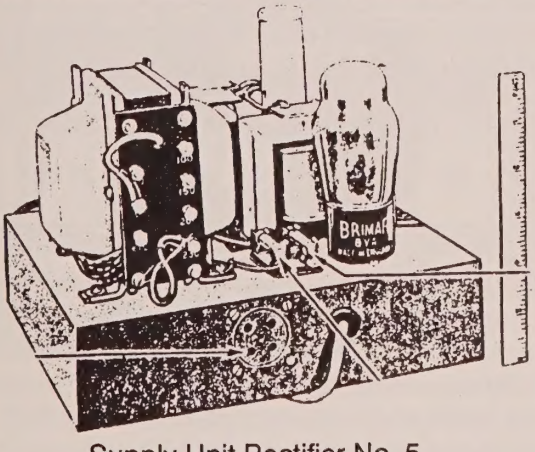
R106 DF No. 3 was a modified HRO version 4 with an adaptor plate over the aerial recess and a special DF system switch (search-DF-sense). The modified plug-in coil sets could not be interchanged with standard units.

R106. The National HRO receiver was adopted in the British Army as Reception Set R106. Most of the HROs were version 4. Late in the war HRO-M and HRO-W receivers were purchased, designated respectively R106 Mk I and Mk II.

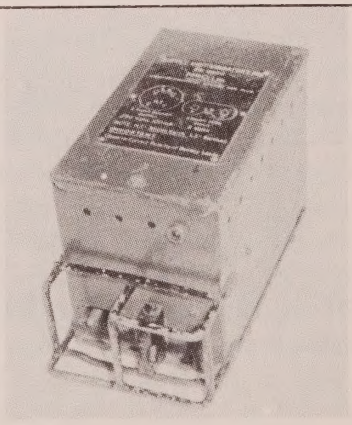
Though original National power supply units were initially used, general use was made of British-manufactured power units. When 100-240 volt AC mains power was available, "Supply Unit, Rectifier, No. 5" was used to supply power to the R106. "Supply Unit, Vibratory, No. 2" was used when the R106 was powered from a six-volt battery. It replaced the National type 686S six-volt vibrapack. Comparing the circuits, it is apparent that the British unit has better filtering. It was built stronger to withstand use in the field. The use of a 0Z4 rectifier is uncommon.

Note: in a 1946 CQ advertisement, "The Radio Shack" offered HRO-W receivers, actually with an identification plate marking "Reception sets R106 Mk II."

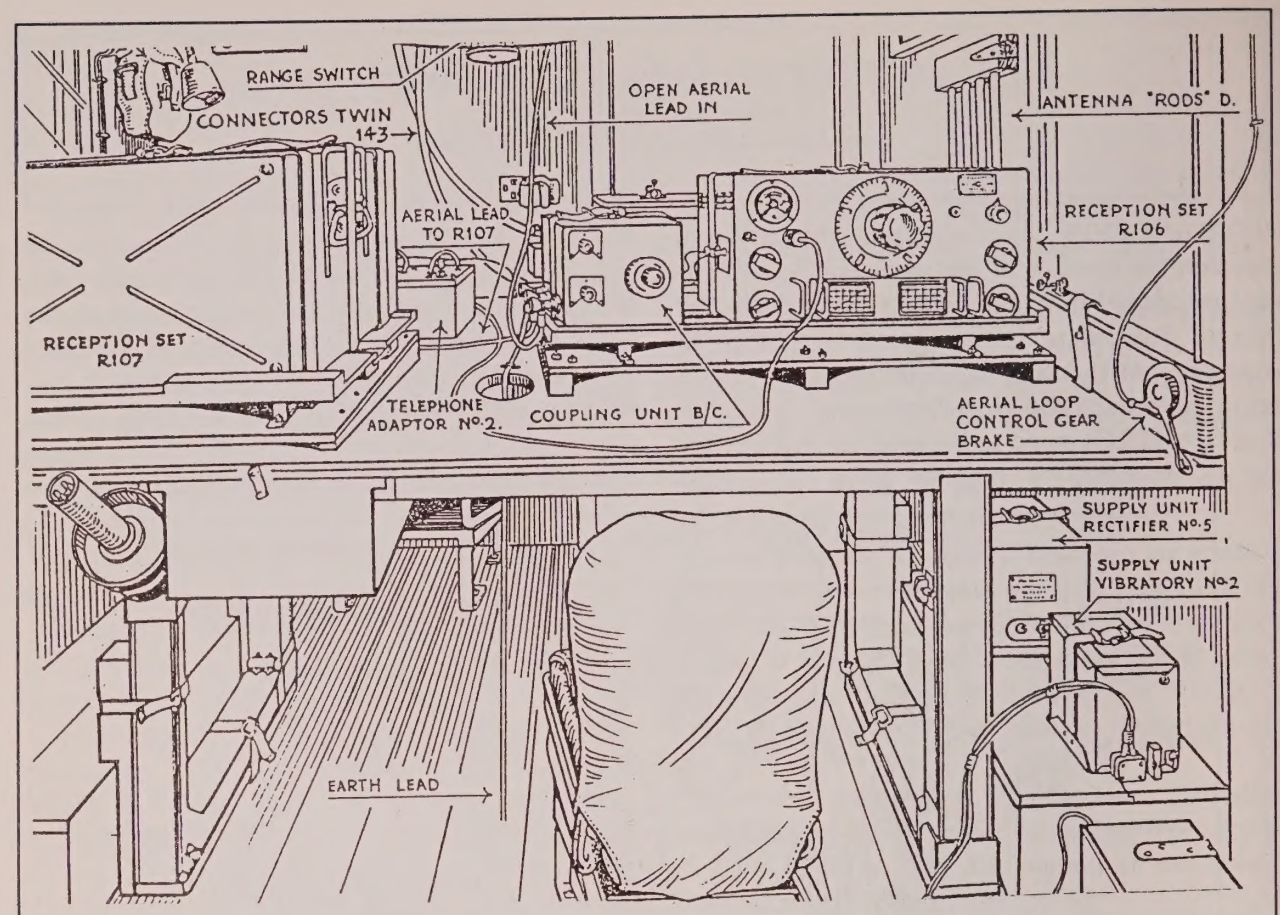
SPECIAL MODIFICATIONS. For communication purposes no modifications were carried out



Supply Unit Rectifier No. 5, AC-mains operated (without cover).

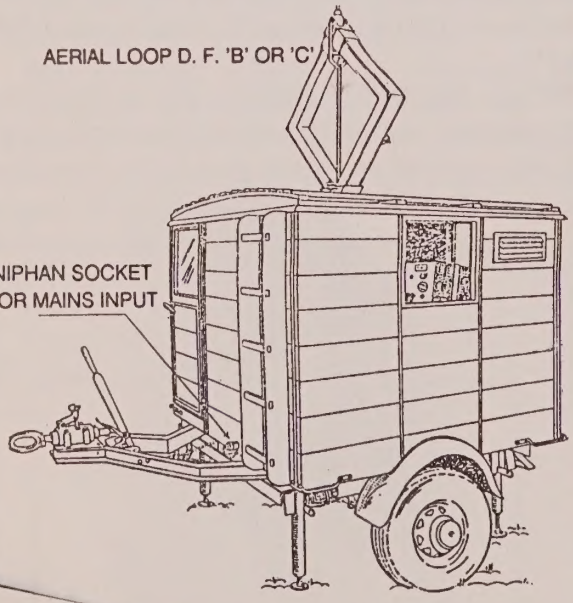


Supply Unit Vibratory No. 2, table-model, for powering an R106 from a six-volt battery.

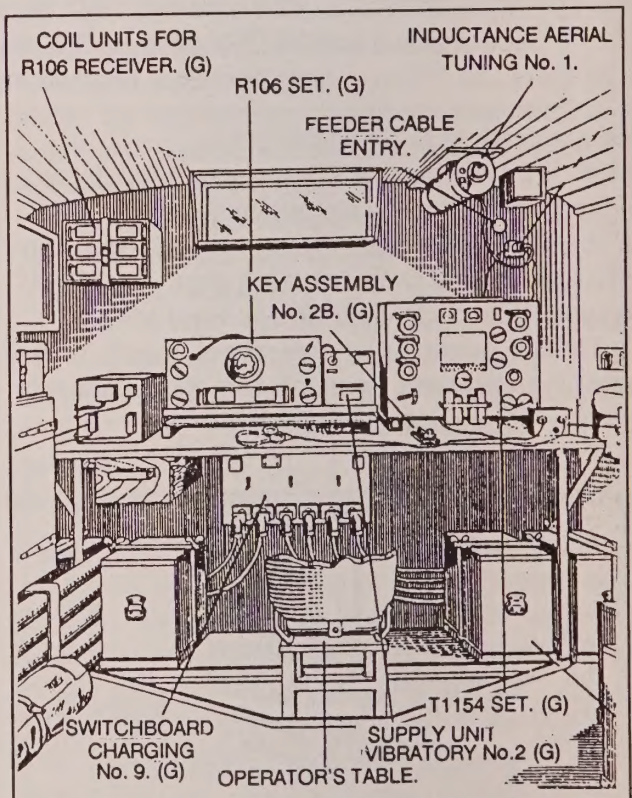


Inside view of Direction Finding station B/C No. 2 in 10-cwt trailer. Note the mounting of the R106 main DF receiver in a cradle, with a Coupling Unit connected to the loop aerial. Both mains and battery power units are mounted on the wheel arch on the right. Reception set R107 (seen in rear view) was used for intercommunication, worked by a second operator.

on the R106 receivers. Due to its extended frequency range (50 kHz - 30 MHz with all coil sets), the receiver was adapted as a basic receiver in mobile direction-finding stations. Principal modifications of the HRO/R106 DF No. 2 receivers were the fitting of a special adaptor plate over the



General view of 10-cwt trailer fitted with DF station B/C No. 2.



R106 receiver and T1154 transmitter in a 15-cwt truck: a low-power mobile station which could easily be removed from the vehicle for use on the ground.

aerial recess. It replaced the original aerial terminals, providing shielding of the input leads from the goniometer or DF loop coupling unit. R106 DF No. 3 receivers were fitted with a special DF function switch and had modified coil units not interchangeable with standard units.

OTHER OPERATIONAL USES. It is interesting to note that the HRO receivers were used in a series of "special stations," developed from early 1940 until 1942. The stations were intended to provide communication over long ranges during combined operations and for isolated parties such as special forces and clandestine operations.

A second example of the multitude of applications of R106 receivers in the British Army is the 15 cwt (3/4 ton) wireless truck. This medium-range mobile station, fitted in a 15-cwt truck, comprised an R106 receiver and T1154 transmitter. The use of an RAF T1154 transmitter, actually designed for airborne work, is noteworthy.

ACKNOWLEDGEMENTS. Thanks are due to the Deputy Director and staff of the Royal Signals Museum, Blandford Forum, Dorset, UK, for their help and permission using the pictures in this article.

REFERENCES

Note: SRDE stands for the British Signals Research and Development Establishment, which was responsible for development of signal equipment in the British Army.

"Special Set Type 1, General Description," SRDE Pamphlet No. 236a, May, 1940.

"Wireless Set, Special, Type 6X1, General Description," SRDE Pamphlet No. 331a, July 1942.

"DF Station, Mobile BC No. 2 in 10-cwt Trailer, Working Instructions," SRDE Pamphlet No. 543, 1945.

"DF Station Transportable, Adcock, No. 1, Working Instructions," War Office, March 1945.

"Reception Set R106 (National HRO Receiver), General Data and Working Instructions," British Army Staff North America, 1944.

"Truck 15-cwt Wireless Stations, T1154/R106, Working Instructions," SRDE Pamphlet No. 399a, Dec. 1943.

"The R1155 Receiver and T1154 Transmitter," OTB, Vol. 31, No. 4 (February 1991).

Communications Receivers, The Vacuum Tube Era: 50 Glorious Years, Raymond S. Moore, 1987.

(Continued from p. 10)

are constantly running out. We update the list of what's available with each new *OTB*, so please check the current list when ordering to avoid disappointment. - LAS

NOTICE - PLUS 5 kHz!

Effective immediately the 75-meter SSB nets will operate 5 kHz higher when QRM is on the primary frequency: 3837 to 3842 and 3867 to 3872 kHz. - BK

BULLETIN DEADLINES

As with any publication, producing and printing the *OTB* take some lead time. In submitting material for publication, please adhere to the following dates for the May issue: want ads, March 11; news items and meeting notices, March 18. - LAS

AWA MEMBERS HONORED BY RCofA

The Radio Club of America has presented Ralph Williams, N3VT, with its Batcher Award for historic documentation and preservation. Jack Davis has been elected to the grade of Fellow, joining last year's honorees Alan Douglas and Gilbert Houck. Congratulations!

AWA BUSINESS MEETING - NOVEMBER

The annual AWA business/board meeting took place on November 3 in Rochester. Since six Board slots were up for election, Lauren Peckham presented a slate of incumbents, who were reelected. Likewise, the position of president was open, and Bruce Roloson was reelected for a two-year term.

Joyce Peckham reported membership as 3695, up 131 for the year. Richard Ransley covered the meets, AWA and jointly-held, for the year. Bill Fizette and Lauren Peckham reported on the Annual Conference, with plans to repeat the Book Fair in 1992 and add flea-market space.

Bruce Kelley discussed 1991 activities of the Museum and 1992 plans: the coverage in the April issue of *QST*, support for other museums' exhibits, special tours, production of video shows by John Ward and others, and general improvements. There was general discussion of upcoming requirements of the Financial Accounting Standards Board for museums to inventory their physical assets with an appraised value, a requirement likely to take effect in 1993-96.

Dexter Deeley presented a budget for the coming year. It appears that continuing increases in Association activity, coupled with the effects of past postal-rate increases, require a raise in membership dues. (These were last raised at the end of 1986, when the *OTB* was normally 44 pages.) The Board voted with reluctance to raise the basic rate to $12 per year ($15 foreign), but this is not to take effect until July 1, 1992, with *a discount for multiple years*: a two-year membership will be $22.

Ludwell Sibley described the publications situation, in particular requesting and receiving funding for an *OTB* commemoration of 1992 as the 40th anniversary year of AWA. He described plans for availability of a publications index on magnetic disc.

(Continued on p. 39)

THE HRO-600

Michael Tannenbaum, K2BN
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In the late 60s National gradually slipped from view. First the regular ham articles disappeared. Then the back-page advertisements vanished, and finally all ads for ham gear disappeared. The last ads promoted the HRO-500, which by then was up to over $1,500 in 1967 dollars. No doubt the reasons for this gradual fadeout will make a fine story but as far as most amateurs were concerned, National was history.

However, in the military market the company was very much alive. In the late '60s and almost up to the current time they produced and supported a line of specialized communications equipment. There was, however, one last HRO: the -600. Needless to say, this HRO was not priced to attract the ham buyer and was not produced in large numbers. Jim Musgrove, K5BZH, noted in a recent article "The Classic HRO and Its Evolution" in *Electric Radio* that the 1979 National brochure listed the price of the '600 at "only" $5,600. He added that he had never seen one. Such was the case for most HRO enthusiasts; the HRO-600 was almost a myth.

In 1988, I visited Antique Electric Supply in Phoenix and purchased Fred Osterman's Shortwave Receivers Past and Present. This fine publication is an excellent guide to all sorts of exotic shortwave receivers. As I usually do, I scanned the page on National. Only two receivers were listed, the HRO-500 and -600. The listing included pictures of the two receivers. All at once the myth had flesh and became real.

Last summer I was offered a chance to acquire a real live HRO-600. After resisting the acquisitive urge for at least five microseconds, I snapped up the receiver featured in this article.

When I looked at the HRO-600 for the first time, I was strongly reminded of the famous Mark Twain novel A Connecticut Yankee in King Arthur's Court. In this tale, the hero used 19th Century technology to solve 12th Century problems. Since essential materials had not yet been developed, he used ingenuity instead. The result was 19th Century applications of 12th Century materials.

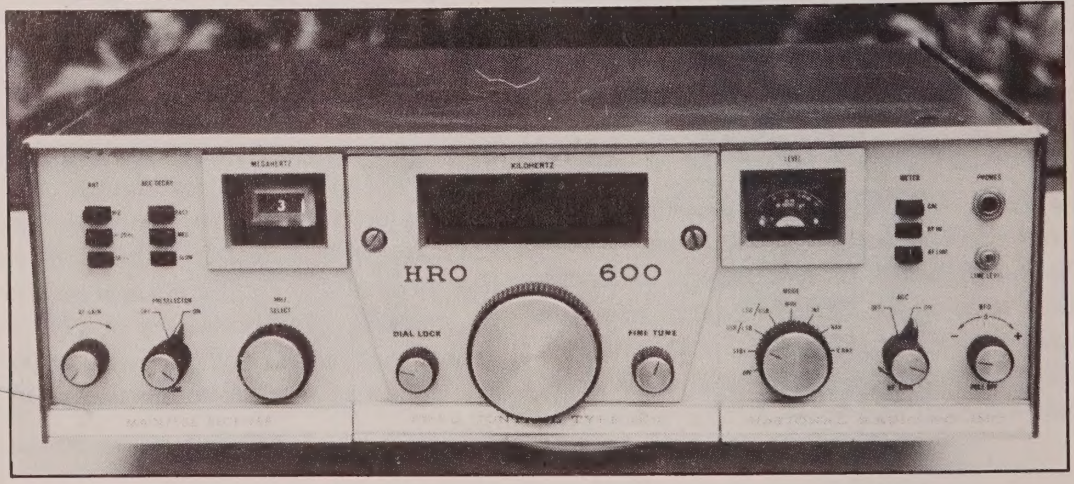
The HRO-600 looks and operates like a modern Japanese receiver. There is a numeric display, broadband front end, and a variety of crystal filters for selectivity. Housed in a low-profile cabinet, the receiver looks nothing like an HRO. Inside the cabinet it looks more like a mini-computer than a receiver. Most assemblies are modular and plug into a "main frame."

However, the influence of computer technology stops there. Unlike the modern Japanese equivalent, there is no internal processor. Although the first injection-frequency synthesizer is controlled by read-only memory, it is programmed with actual diodes. Display and counter circuits are actual individual IC logic elements and frequency-determining circuits are switched by motor-driven switches.

The -600 also lacks the functional beauty of its HRO-500 predecessor. In the -500, I believe National created one of the best looking communication receivers ever made. Not only is the PW dial good looking but the receiver has a delightful symmetry. The -600 not only lacks the PW dial but is squat and wide.

However, when it comes to operation the -600 blows the -500 away. In the -600 National abandoned the 500-kHz bands of the past. The -600 covers 16 kHz to 30 MHz in 30 one-MHz bands. Also, unlike the -500, no outboard preselector is required to tune frequencies below 500 kHz. The self-contained -600 even has its own little speaker built in.

When it comes to frequency control, the -600 is



in a class by itself. It is basically a frequency standard. The VFO's VCO is locked to an oven-controlled crystal frequency standard. A one-MHz frequency counter reads out the selected VFO frequency on four digital Nixie glow tubes. When the range tuned exceeds the counter range, a + or - symbol is turned on.

The entire VFO assembly, designated the 601 Scanning Unit, is removable. It could be replaced by the 602 Synthesizer (frequencies selected by thumbwheel switches) or the 603 Fixed Channel Unit with twelve crystal-controlled channels. Additional accessories included the 650 FSK Converter and 640 ISB Adapter.

The technical manual included with the receiver was clearly not directed at Joe Ham. While it includes the usual sections on installation, operation theory, and maintenance, whole sections of detail on individual modules are missing. Clearly the HRO-600 was designed for depot, not field, maintenance.

Maintenance also requires special extender boards. These boards are not likely to accompany the HRO-600. If alignment of the front end module or second IF is required, an extender must be obtained.

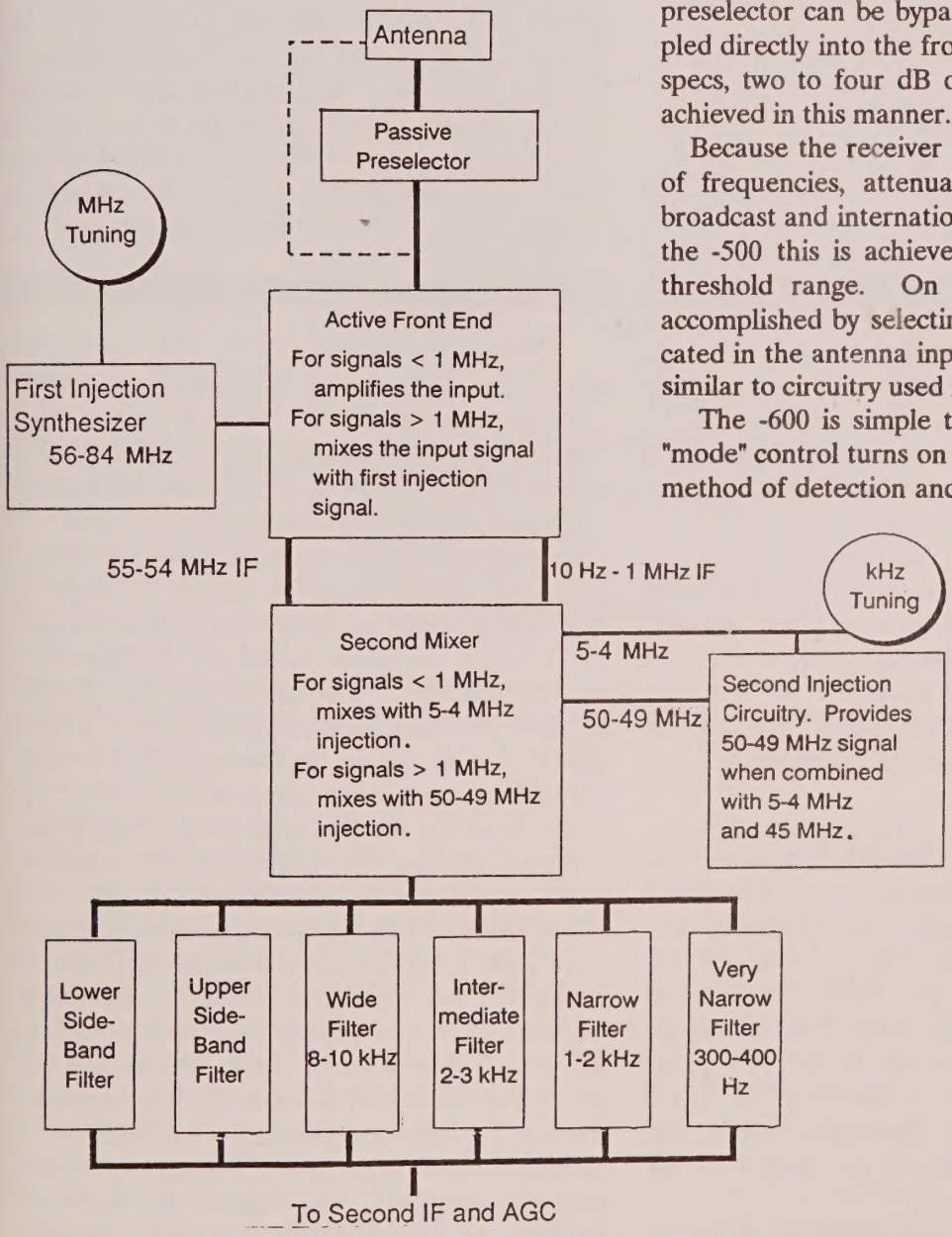
Fortunately much information about this receiver has survived. DAR Electronics (229 Marginal St., Chelsea, MA 02150) has copies of the original manuals and the detailed bench service manual. Most of the parts on the boards are either generally available ICs or discrete transistors. Even extender boards can be fabricated and the alignment tools required are standard stock items. It *is* possible to service this radio.

Functionally the -600 is rather simple. Below 1 MHz it is a single-conversion superheterodyne. Above 1 MHz the receiver uses double conversion. The signal path is altered by relays located on the modules affected. Selectivity is obtained from a passive preselector and multiple crystal filters. As the block diagram indicates, the preselector can be bypassed and the signals coupled directly into the front end. According to the specs, two to four dB of additional gain can be achieved in this manner.

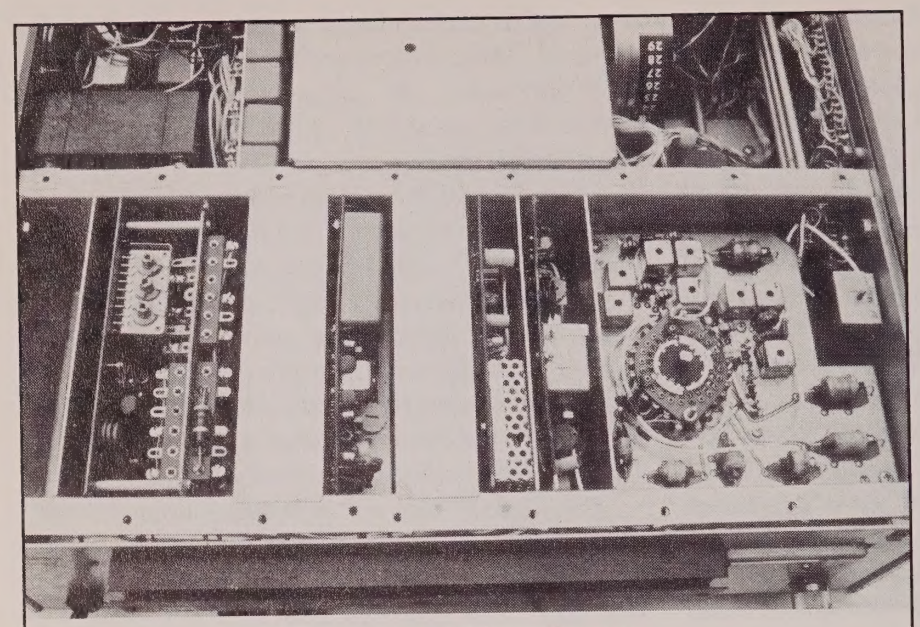
Because the receiver covers such a wide range of frequencies, attenuation is required on the broadcast and international shortwave bands. On the -500 this is achieved by adjusting the AGC threshold range. On the -600 attenuation is accomplished by selecting a resistive network located in the antenna input circuit. The process is similar to circuitry used in the Kenwood TS-930.

The -600 is simple to operate. Rotating the "mode" control turns on the power and selects the method of detection and selectivity. Selectivity is fixed at 2.4 kHz for upper and lower sideband and varies from wide (8-10 kHz) to very narrow (300-400 Hz) for AM and CW. Frequency is selected by rotating the MHz knob (just as in the Collins receivers) and selecting the kHz on the VFO knob.

When tuning sideband signals, the BFO is fixed at 5 MHz, the proper upper or lower sideband filter selected and the product detector automatically switched in. While this is common practice with to-day's com-



HRO-600 BLOCK DIAGRAM



Top view, seen from the rear.

munication receivers, it differs from the -500, where the passband tuning control had to be varied to select the wanted sideband.

Unlike most modern receivers, there is no passband tuning for any mode. Either the crystal filter selected got rid of the interference or you lived with the result. Also, unlike the -500, there is no rejection filter to get rid of interfering heterodynes. However, it all seems to work quite well.

In comparison to other receivers in my collection, the -600 fares quite well in the sensitivity and selectivity area but not as well in terms of audio. The tube HRO-60 is superior in that respect. As to how it relates to the modern (well, almost modern!) Kenwood TS-930, there really is no comparison. The TS-930 has controls and features that the -600 cannot match. I also suspect that if I had ordered the -930 with its optional TCXO, it would have equalled the -600 in frequency accuracy and stability.

Of course, utility is not the primary need for a collector. The facts are that quality and rarity will demand a premium in the future. Nobody says that a Marconi magnetic detector functions as well as a late-model receiver but any serious collector would kill to have one in his collection. I believe that the last of the famous HROs is in this league . . . and you can even use it for short wave listening or hamming right now!

(Continued from p. 20)

Delayed QSL: Every now and then one reads of a letter delivered after a delay of many years. I experienced a like situation when I recently received a 54-year-old QSL from W9NN confirming a QSO on 14284 kHz, 4:38 PM, Oct. 3, 1938. My call was then W8ACY.

Lost-Found Fax: For several years I've been searching for a misplaced prewar Finch facsimile machine. It was finally located under several cartons of tubes in the old Museum. AWA is also the owner of a 1939 RCA machine. With current interest in fax, these machines would make a nice historic display.

Mechanical Amplifier. The Multi-Audiphone, the Western Electric mechanical repeater element, and the S. G. Brown amplifier all preceded the vacuum tube as means of amplifying telephone and radio signals. A crude device, the Brown unit was developed before WW I and used in England in the early '20s to amplify broadcast signals from a crystal set. A working model of this device is described in Geoff Arnold's *Radio Bygones* (November issue). An original Brown amplifier is on display in the AWA Museum.

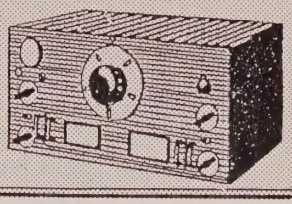
Enigma Machine: Are you interested in spy radios, cipher machines and other secret code devices? If so, look for an article in *Radio News*, January, 1924, page 878. Having read the intriguing book The Enigma War by Jozef Garlinski (Scribner's, 1979) I thought I knew the history of this WW II German code machine. Not so.

While thumbing through this issue of *Radio News*, Ed Allison found an article, "Secrecy in Radio" describing an encrypting mechanism using rotating cylinders, called an "Enigma Ciphering Machine." The device was used in the 1920s by the German Postal Department. It was modified in the '30s by the Germans (and Polish) for military use. In the words of the article, "[i]t would seem for the first time to solve the problem of translating secret messages into a cypher which cannot possibly be detected . . ."

The British broke the system by removing a set from a captured German submarine and used it during the war without the enemy's knowledge. Collectors are now paying thousands of dollars for one of these devices. Keith Geddes showed me two in the British Science Museum archives; there is also one on display in the Smithsonian.

European Radio Museums: Planning to visit Europe this summer? Pat Leggatt will tell about both large and small museums in the British Isles and on the Continent in the next OTB.

THE COMMUNICATION RECEIVER



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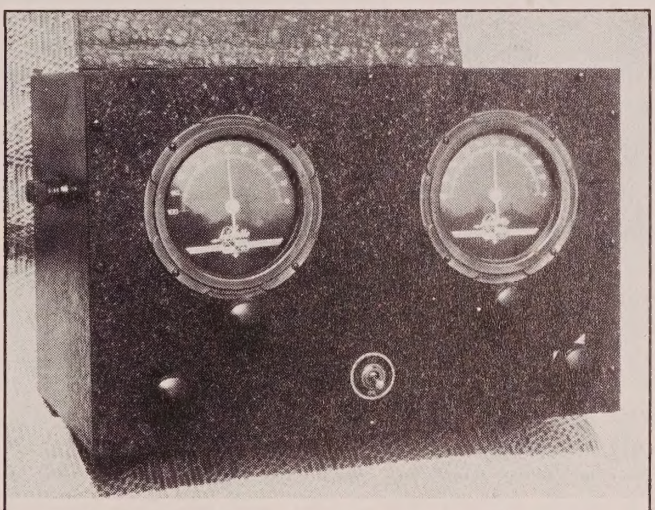
All correspondence requires SASE for reply

THE 1935 LAFAYETTE 56-MHz SUPERHET KIT

William B. Fizette, K3ZJW

In looking back at the world of the communication receiver as of 1935, we usually think of the HRO, the Super-Skyrider, Super-Pro, the various RME and RCA models, and other high-frequency workhorses. We tend to overlook the serious UHF work that began in the late 1920s in the 5-meter band (it had become an amateur band in 1924) and which was beginning to show real results by the mid-Thirties.

While a few pieces of commercially manufactured VHF gear were on the market in the early Thirties, for the most part equipment was in the realm of the experimenter, and consisted primarily of the modulated-oscillator transmitter and the superregenerative receiver. The latter was remarkably sensitive to weak signals, and also amplified CW signals much more than the background noise. Its big disadvantage was the strong signal radiated by the oscillator/detector, and in crowded areas the QRM was getting serious. The circuits in use were inselective, and many operators objected to the characteristic 'rush' noise in the absence of signal.



The Lafayette 5-meter kit receiver. The audio gain control is on the left, and an added regeneration control on the right. The knobs are standard National design.

Attempts to use 56-MHz superhet receivers had, however, been unproductive, and serious communications work continued with the superregenerative circuit. In mid-1935 the Lafayette 56-MHz kit receiver was introduced in an effort to change the picture.

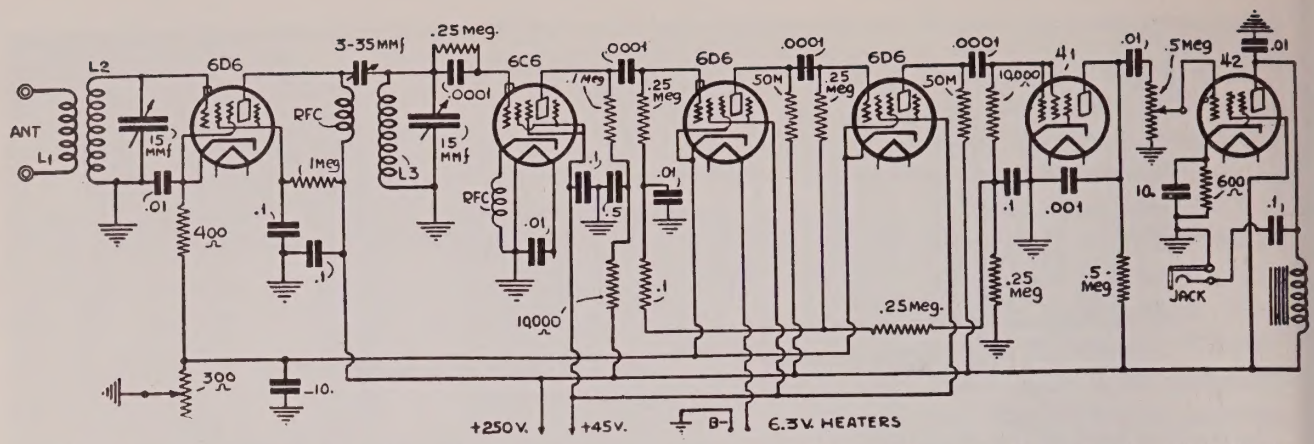
The circuit was a modification of a design by Frank C. Jones, W6AJF, a well known experimenter and writer of the period. Manufactured by the Wholesale Radio Service Co. of New York, it was marketed under the Lafayette Radio name as a simple, easy-to-assemble kit.

The six-tube receiver consisted of a 6D6 tuned RF stage, a 6C6 autodyne first detector/oscillator, and two 6D6 RC-coupled IF stages, followed by a 41 second detector/AVC and a 42 audio output, capable of driving a dynamic speaker to full volume. The constructor could also plug in the equivalent 2.5-volt tubes. An ordinary external power supply, not supplied with the kit, was required. Batteries could also be used for portable work. Price was $16.75, less tubes; $8.25 more for the power-unit kit. The set was also available wired for $3.25 more.

The oscillator circuit is unique. The grid circuit of the oscillating first detector was detuned slightly from the signal frequency, giving a low-frequency beat note at the IF frequency. Plate-to-grid feedback was obtained by using a cathode RF choke, and the circuit constants were chosen to give smooth feedback, but not superregeneration.

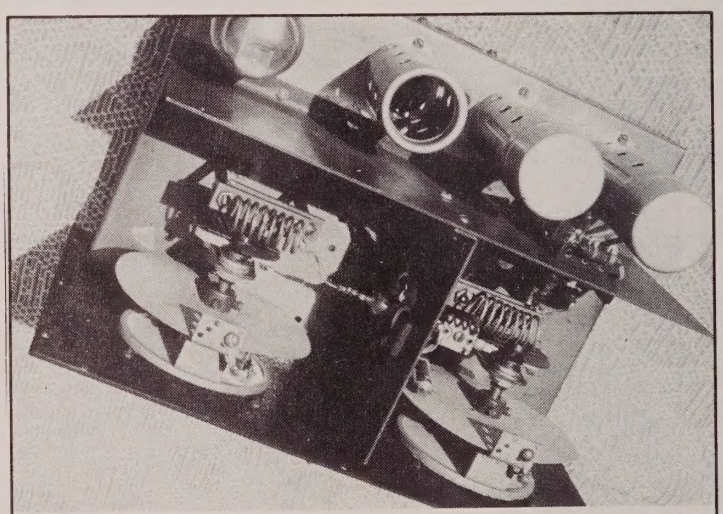
The IF-stage constants were selected to pass the IF but reject the audio frequencies, allowing modulated-oscillator signals to be received with a relatively sharp IF system. In particular, the use of very small coupling capacitors (100 pF) and the stray capacitances of the circuit together gave an IF passband from about 15 to 100 kHz. The manufacturer noted the advantages of using the RC-coupled IF system; not mentioned was the fact that it was considerably cheaper to build. The wide IF passband (and essentially zero suppression of the image frequency) gave selectivity superior to that of a superregenerative set, but wide enough to accept the wobbly signal of a modulated-oscillator transmitter.

In the true radio-amateur spirit of the times, several variations of the circuit were available. For example, the 400-ohm RF gain control shown



on the circuit diagram could be omitted and a regeneration control added. The latter varied the DC voltage to the first detector through a 50K pot from the 45-volt source.

The original catalog text somewhat embarrassedly admitted that the 6D6 RF stage provided little gain, being more useful as an antenna isolator to stop local-oscillator radiation. *That* changed soon: by December, a new version was being advertised in such magazines as the *Short Wave Digest*. The RF and first detector tubes were replaced by RCA 954s (acorn UHF pentodes announced in March and covered in *QST* in May, 1935), a B+ switch added, the speaker jack moved to the rear apron, and the antenna terminals relocated to the side of the cabinet. The 954 offered substantially better performance than its predecessor; the new set must have worked much better. The new model had Lafayette logos on its airplane dials, replacing the plain versions depicted on the original. It came factory-wired for $26.50, less tubes; power supply, $9.50 more.



A close-up view of the same receiver. This example has been modified into the later version: the 954 RF tube (left) and 954 first detector (right) replace the 6D6-6C6. At top (right to left) are the two 6D6 IF stages, 41 (absent in this picture) and 42 audio.

The basic set construction was both attractive and substantial. The heavy copper-plated steel chassis was topped by a large T-shaped shield, isolating the various stages. The black wrinkle-finished steel cabinet was devoid of labels. In most versions, the coils were a plug-in design mounted on stand-off pillars, allowing for both short grid leads and the substitution of 10- or 2-½ meter coils if desired.

The lab performance evaluation of the receiver in *R/9* magazine (October 1935) was almost glowing, emphasizing the ease of operation and the overall stability. The superhet circuit minimized the radiation so common with superregenerators, and the objectionable 'rush' noise characteristic of the latter was absent.

Despite the obvious appeal of the acorn-tube version, a "7-Tube Resistance Coupled Super" appeared in the 1937 edition of the Jones Radio Handbook, still using the 6D6 and 6C6, virtually identical electrically to the initial model but with a different parts layout. A simpler companion set omitted the RF and audio output stages.

DISCUSSION

In reviewing source material for this article, the writer was struck by the divergence of opinion expressed by various writers and experimenters in 1935. An engineer for the Wholesale Radio Service Co. stated in an article describing the set (*Radio*, July 1935) that a 5-meter superhet would give definitely superior performance in terms of sensitivity, selectivity, and noise level as compared to a superregenerator. The annoying 'rush' noise would be missing, and radiation of oscillator signals minimized.

On the other hand, Ross Hull, a noted *QST* authority on high-frequency experimental work, took the position that the superregenerative receiver was the backbone of all UHF work, and that when properly designed, built and adjusted would "run rings" around all other designs (*QST*, Nov. 1935).

Even the post-war National HFS high-frequency receiver was a modified superregenerator. There is obviously much more to the discussion, but we will leave it there for now. Readers are invited to comment.

MORE ON THE ANNUAL CONFERENCE

We gave a "flash report" on the Rochester annual conference in the October OTB. Here is added information that may be of interest.

Attendance was reported as "over 600." The final figure for paid registration turns out to have been more like 880!

Recipients of awards at the Saturday evening banquet this year were:

AWA Houck Award for Documentation *and* **Tyne Tube Award**: John Anderson, for his three studies of tube development, general electronics research, and business history of the General Electric Company in the AWA Review.

AWA Houck Award for Preservation: Bob Paquette, for his comprehensive, documented collection of antique microphones.

Cundall Old-Time Contest: Marshall Etter, W2ER, for his top score for a second year.

Thompson "Best of Show Award: Jim McKinnon, for his Aeriola Grand display in the Equipment Contest.

Taylor Television Award: Pat Leggatt, for his history of British television in the Review.

Matlack Award: John Rollins, W1FPZ, and Parker Heinemann, W1YG, for their "hero" restoration of a 1934 Gross Radio amateur station as displayed in the Equipment Contest.

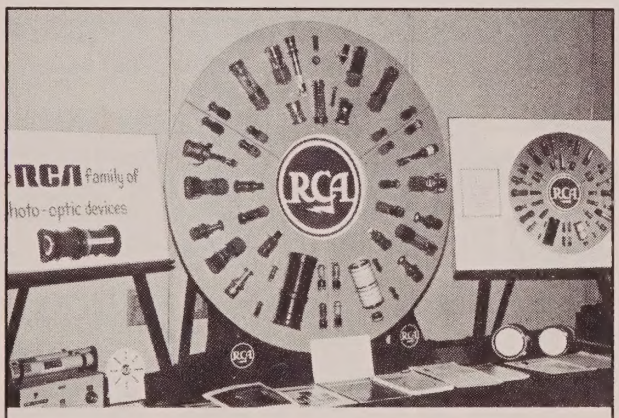
Display Award: Floyd Jury, for his exhibit of RCA photo-optic devices made at the Lancaster plant.

BK-OTB Award: Lloyd Espenschied, for his "How Did de Forest Invent the Grid Audion?" in the October 1990 issue.

President's Award: Dexter Deeley, for his long-term service as accountant and treasurer.

For those planning to build up contest exhibits, the 1992 Conference will feature the GE Company, in its centenary year.

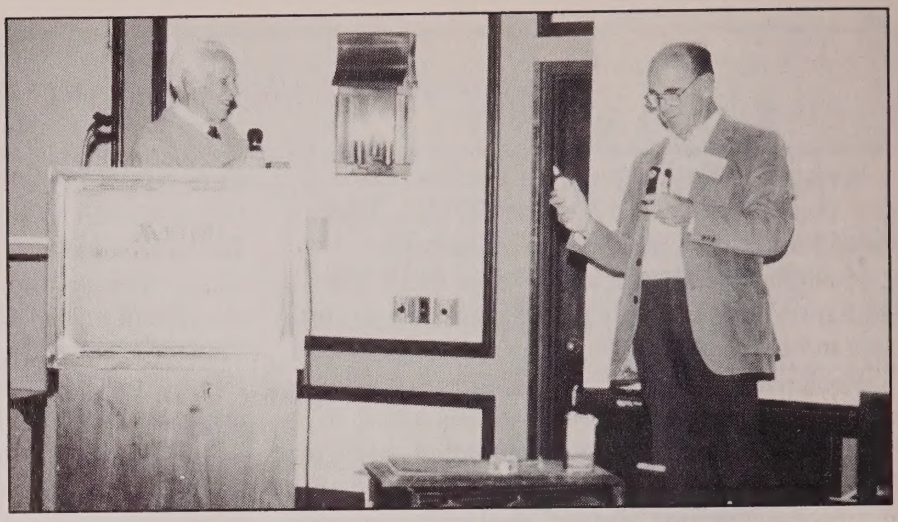
The Marriott is taking reservations at special conference rates until September 2. Rooms will be $75 per night single occupancy, $85 double, $95 triple, or $105 quad. The number is (716) 359-1800. - LAS



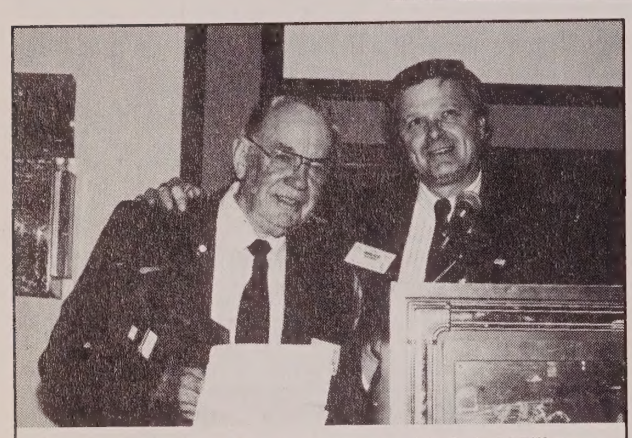
Floyd Jury's photosensor display. *(Richard Ransley photo)*

Parker Heinemann taking care of business in the flea market. *(Bob Cobaugh photo)*

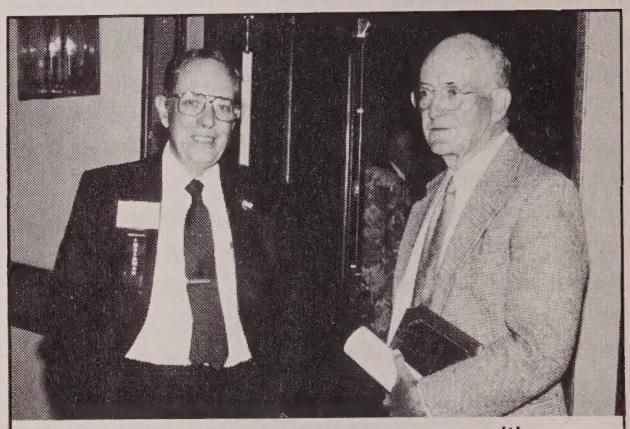
EVERY YEAR AT THE AWA FLEA MARKET IT'S THE SAME STORY!!



Mel Comer introduces Robert MacIntyre, about to reveal his secrets of radio restoration. *Richard Ransley photos*.



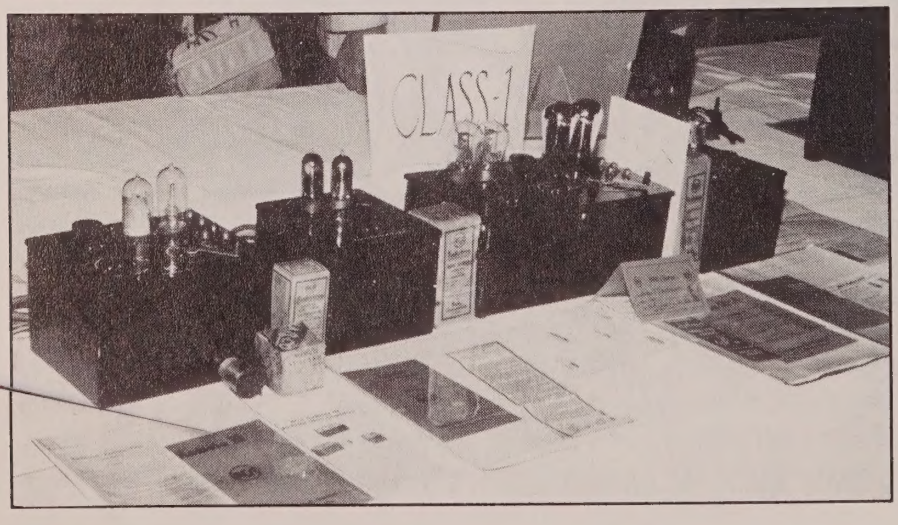
Equipment Contest organizer Ralph Williams with Bruce Roloson.



Bill Fizette, Conference manager, with ace CW operator Marshall Etter.

Pat Leggatt receives the Taylor Award from Ross Smith.

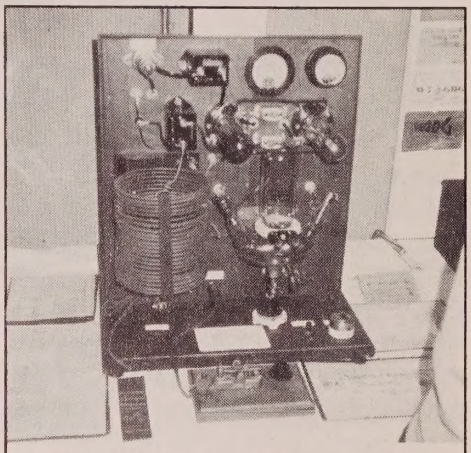
Chuck Brelsford, AWA founder, and Tom Lewis, author of Empire of the Air.



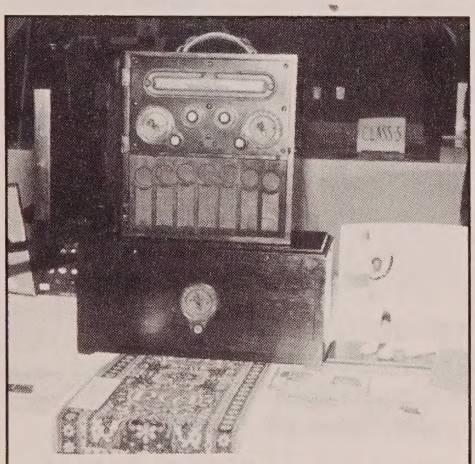
Robert Trauterman's Radiola III display: the III, Balanced Amplifier, and IIIA.

A fine Fall day in the flea market.

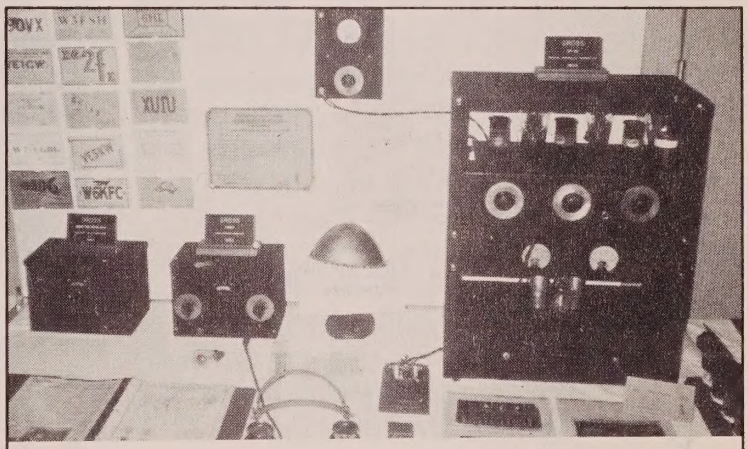
Robert Lozier and his *Ricevitore Italiano* exhibit.



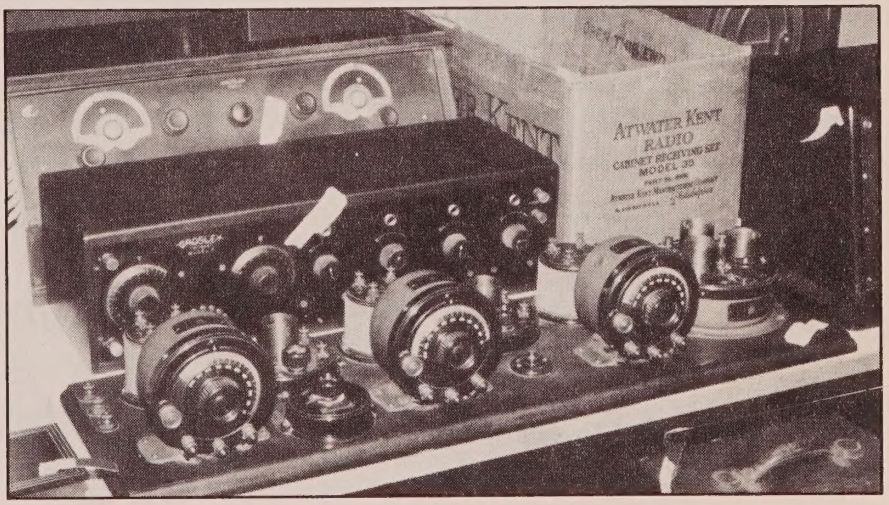
Edward White's 1XM transmitter replica.



Tom Pamula's Radiola 28 - Nipper display.



Gross frequency monitor, "Eagle" receiver, and CP-25 transmitter - the Rollins-Heinemann restoration.



An Atwater Kent 10 breadboard, 35 "bathtub" set, and a Crosley ready for auctioning.

AMATEUR RADIO

EDITED BY
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Box 7, E. Bloomfield, NY 14443
All correspondence requires SASE for reply.

OLD-TIME CW CONTEST

A MEMORIAL TO LINC CUNDALL, W2LC

DATES and TIMES: Feb. 19-20 and 22-23. Start at 2300Z Feb. 19 (6:00 PM EST) and end at 2300Z Feb. 20 (6:00 PM EST). Repeat on Feb. 22-23.

OBJECTIVE: Contact the greatest number of AWA members. When calling, use "AWA AWA AWA de W2AN," as an example. On contact, exchange year of equipment, such as "TX 36" for a 1936 transmitter and "RX 34" for a 1934 receiver. Send "MOD" for modern (1942 or later) gear.

RULES: A station will be scored only once on each band. Nonmember contacts, and stations not submitting logs, will not count.

FREQUENCIES: 1800-1820, 3580-3600, 7030-7050, and 14060-14070 kHz, ± QRM. Concentrate 160-meter contacts on the hour.

SCORING SYSTEM:

QSO Zones: "E" eastern zone: US districts 1, 2, 3, 4, 8, 9 plus VE1, VE2, and VE3. "W" western zone: US districts 5, 6, 7, 0 plus VE4, VE5, VE6, and VE7. "DX" zone: All others.

QSO Points per Contact, by Zone:

"E" to "E" or "W" to "W": 1
"E" to "W" or "W" to "E": 2
"E," "W" or "DX" to "DX": 3

Equipment Multipliers:

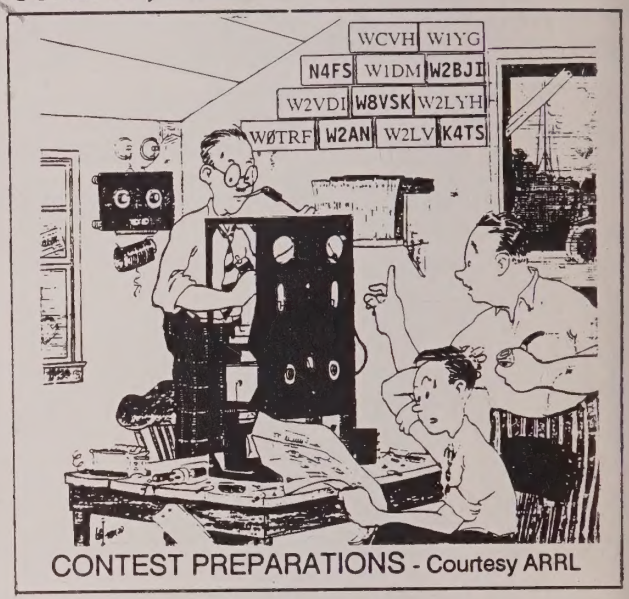
Equipment	Multiplier
MOD TX and RX	1
OT TX or RX	2
OT TX and RX	3

Power Multipliers (input to final):

100 watts and up: 2
10-99 watts: 3
0-9.9 watts: 4.

Determining Total Points per QSO

1. Find QSO points for the contact.
2. QSO points X your equipment multiplier X your power multiplier = Total points for the contact.



CONTEST PREPARATIONS - Courtesy ARRL

Examples:

1. W2AN contacts W2LV.
   Both are in "E" zone, for one QSO pt.
   Both have OT TX and RX, for 3 multiplier.
   Both are running 80 watts, for 3 multiplier.
   1 pt. X 3 X 3 = 9 pts. for contact.
2. W2BJI contacts W7BCT.
   "E" to "W" zone contact, for 2 QSO pts.
   W2BJI: OT TX and RX with 80 watts.
   W7BCT: OT RX; MOD TX at 120 watts.
   W2BJI's points: 2 pts. X 3 X 3 = 18 pts.
   W7BCT's points: 2 pts. X 2 X 2 = 8 pts.
3. W2AAU contacts W2AN.
   Both are in "E" zone, for 1 QSO pt.
   W2AAU uses MOD TX and RX, for equipment multiplier of 1; is running 120 watts for power multiplier of 2.
   W2AAU's points: 1 X 1 X 2 = 2 pts.

LOG SHEETS: will be sent to previous entrants. If you have not entered, write below for logs.

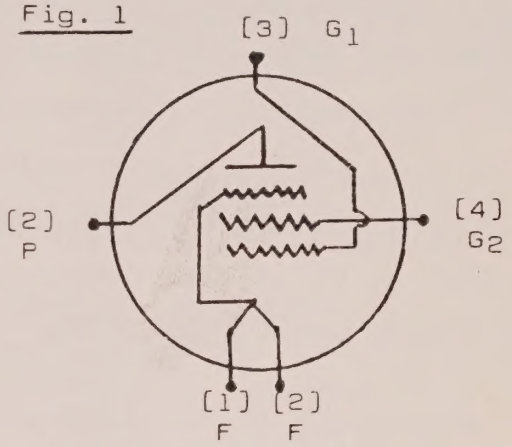
SEND LOGS TO: John Ward, KE2ST, Box 7, E. Bloomfield, NY 14443 by April 1.

4.) the P730 used in battery operated portable sets and later known as the Type 33. The P703, similar to the P704 in the photo, was a sort of "beam" pentode having the G_1 and G_2 grids aligned. The Champion Company may have missed an opportunity for patent claims of the "beam action" later developed by R.C.A. The P703 required less screen current and voltage than the P704, PZ or 47. However, the P704 design was chosen because the idea of aligned grids was considered impractical due to more exact assembly in production lots. The best design compromise at the time was to use a nonaligned G_2 with respect to G_1 and G_3 and having the direction of winding of G_2 opposite to that of G_1 and G_3. Also the pitch of G_2 was different from the other grids. The net result of this design, though requiring a higher screen current, did provide a fairly uniform field between the grids.

Early in 1931 Champion demonstrated a "home brew" receiver using the P703 at the Atwater Kent plant in Philadelphia. This set was compared to an Atwater Kent model using '45 triodes in the output stage. Mr. Atwater Kent was there to personally evaluate the test. He was immediately sold on the performance of the pentode, and as a result, the PZ and P704 pentodes were used in the first Atwater Kent superheterodyne of 1931. The P703 was replaced by the P704 as mentioned above. Later on, type 47 pentodes were available from R.C.A. and other tube manufacturers.

Early pentodes were found to perform very effectively as R.F. amplifier tubes. The original P701, modified to have a control grid top connection, was used as a R.F. buffer amplifier in a local broadcasting station in 1929. It was an early version of the 802, 803, 804, and RK20 and performed better than the 865 tetrode it replaced. The '47 of course was very popular with amateurs for use in R.F. circuits before a wide variety of pentodes or beam tetrodes became available. ***

Fig. 1



Bottom of UY Socket
Type '47

One tube, the HY69, a "quick heater" version of the 807 made by the Hytron Corporation in 1937, had a thoriated tungsten filament. It was one of the first of its type and was used in police two-way radios. The HY69 was one of a series of Hytron tubes available to amateurs prior to World War II. Two of these tubes in the writer's collection were recently used in his 160 meter rig. After a 35 year rest, they still met the operating specifications. It was found that the HY69s were very nearly as efficient as the modern 6146A beam tetrodes.

* See: "About the Pentode" by Ross A. Hull, QST June '31
See: "Putting the Pentode to Work" by Ross A. Hull, QST June '31

** Pentode development by other U.S. Companies at this time may have been carried out unknown to the writer.

*** See June '31 QST, "Using Pentode Tubes in the Low-Powered Transmitter" W1BVL

As a vacuum tube engineer and ham, Dick Briggs recognized the great potential in pentode tubes for amateur use. This prompted him to write an article in June, 1931 QST. Here he reviews the subject nearly 45 years later. Dick is a member of the newly formed Vacuum Tube Committee.

Good news ! Starting with the next issue of the Bulletin, Jerry Tyne will again have his "Question and Answer" Column. In the meantime, members of the AWA Vacuum Tube Committee will submit articles of interest.

EARLY PENTODE TUBES

by Richard S. Briggs, W1BVL

The following history of pentode tubes covers activity of early development not generally known. * The first pentodes like the Mullard PM 24 were used in Europe during the late 1920's. They gave more amplification per tube in a set, and because royalties on foreign sets were based on the number of tubes, the pentode became popular.

During 1929 Arcturus Radio Company in Newark, N. J. and Champion Radio Works Inc. in Danvers, Mass. were developing the first American pentodes. ** The writer was directly involved with the pentode program at Champion. At this time there was sporadic interest by set manufacturers. Most engineers were enthusiastic about the pentode but top managements were cautious; one reason being the severe market crash of 1929.

As far as it is known, the first important demonstration of the pentode tube in the U.S. was given to a group of engineers at a meeting of the Radio Club of America at Columbia University, New York City on January 15, 1930. The pentode was the Champion P701. An A.F. amplifier was built by Champion for this demonstration. It consisted of a phono. pickup and audio stage using a 227 triode, the output of which was fed either to the grids of a pair of type 245 triodes in push pull, or to the grid of the P701 pentode depending which way a switch was thrown. The high power sensitivity of the pentode was shown dramatically. The voltage amplification of the P701 was 6.6 times that of the push-pull 245s. In effect the pentode was equivalent to two audio frequency stages using triodes. This made it practical to use one pentode tube stage immediately following the detector in a set.

After the demonstration at Columbia University, interest in the pentode increased rapidly. Champion and Arcturus were encouraged to continue their programs. The result of this was the Arcturus PZ and the Champion P703 both being prototypes for the later type 247 or 47. Fig. 1 shows the internal connections for these tubes.

For those not acquainted with pentode construction, the following information is given. The pentode is essentially a screen grid tube with an extra (suppressor) grid placed between the screen grid (G_2) and the plate and is normally connected to R.F. ground and at zero d.c. potential; and in the case of the type 47 it is connected internally to the center of the filament. The purpose of the suppressor grid (G_3) is to keep secondary electrons from the plate from reaching the screen grid (G_2) particularly when the instantaneous plate voltage swings below the fixed G_2 voltage. This property provides more undistorted power output with greater power amplification than that of an equivalent tetrode.

Starting around 1935 beam tetrodes such as the 6L6 were developed by R.C.A. They were essentially pentodes with beam forming plates used instead of a suppressor grid. The grid wires of G_1 and G_2 were aligned to minimize the interception of primary electrons by G_2 and to also enhance the "beam action". The well known 807 was a modification of the 6L6 and a prototype for many other R.F. power tetrodes.

The photograph shows Champion pentodes of the writer's collection. They were developed between 1929 and 1932. From left to right is 1.) the original P701, 2.) the P704 (prototype 47). 3.) the P702 with an indirectly heated cathode and top G_1 connection,

MORE DATES OF PUBLICATION:
EARLY RADIO/COMMUNICATIONS PERIODICALS

Magazine collector Jerry Berg recently sent in some more listings to supplement the publication dates for radio periodicals given in OTB Vol. 30 No. 4 (February 1990). Here are his contributions and some more, covering radio-electronics-wireline subjects. In many cases, the exact starting or ending dates of magazines are unknown - they are not listed in modern library indexes to periodicals! Readers having fuller information on any of these are invited to send it in. We expect to produce a full listing combining the 1990 list with this and more. - LAS

	⌐ Issues ¬		
Title	First	Last	Notes
American Telephone Journal, The	1900?	post-06	Weekly. May have been absorbed by *Telephony*.
Broadcast Engineering	5-59	-	
Broadcast Management/Engineering	1-65	-	
Broadcasting	10-15-31	-	Absorbed *Broadcast Reporter*, *Broadcasting Advertising*, and *Television Magazine*.
Communications News	10-64	-	Absorbed *Wire and Communications*.
Electrical Communications	8-22	-	Published originally by IT&T; now by Alcatel.
Electronics Illustrated	?-58	1-73	
Electronics World		1-72	Originally *Radio & TV News*. Merged into *Popular Electronics*.
GE Ham News	46	?	May-June 1946 is Vol. 1 No. 1. Nov.-Dec. 1958 is Vol. 13 No. 6.
Ham Radio	?-68	6-90	Merged into *CQ*.
Ham Radio Horizons	3-77	?-78	
Official Short-Wave Listener Magazine	8/9-34	?	Bimonthly; Feb.-Mar. 35 issue was Vol. 1 No. 4. Merged with *Short Wave Craft* ca. 1936.
Radio Age (New York)	?	?	Help requested!
Radio Design	1-28	?	Pilot Radio Co. house organ, published in Jan., March, Sept., and Nov. of the year.
Radio Index (*RADEX*)	?-24	2-42 (?)	Nov. 1926 was Vol. 3 No. 2. Ten issues per year during '30s; then bimonthly from 1940; monthly as of Nov. 41.
Radio World	2-28-22	?	Weekly; monthly in Thirties. Vol. 24 No. 1 is Apr. 1936. Unrelated to today's *Radio World*.
RCA Ham Tips	9-38	>8-70	Began as *Dots & Dashes*, serially numbered, ca. 1935. Vol. 1 No. 1 is Sep. 1938. Bimonthly and monthly, at random. Apparently suspended during WW II. Vol. 4 No. 3 is Jun.-Jul. 1941; Vol. 6 No. 1 is July 1946. Published to at least Vol. 30 No. 2 (Aug. 1970).
RCA Review	7-36	12-86	Suspended during WW II; resumed 3-46.
Telegraph Age	1883	2-65	Semimonthly after 1883. Became *Telegraph and Telephone Age* some time after 1908; then *Wire and Communications* after 1948; merged into *Communications News* in 1965.
Telephone Engineer & Management	1-09	-	Originally named *Western Telephone Journal*. Semimonthly.
Telephony	1-01	-	Weekly.
Western Union Technical Review	7/10-47	?	Quarterly. Ceased sometime after 1957.
Wireless World (British)	4-11	-	Originally *Marconigraph*; became *Wireless World* 4-13. Became independent of the Marconi Company 1925. Titled *The Wireless World and Radio Review* in late '20s. Now *Electronics World and Wireless World*.
73	4-61 (?)	-	

COLLECTING WIRELESS ARTIFACTS IN BRAZIL

Carlos Alberto Fazano
C. Postal 25, Osasco, São Paulo 06001, Brazil

For historical evaluation, the evolution of electronics can be divided into two main eras: before and after the arrival of thermionics. The first period relates to communication by (1) conduction (telegraph-telephone) and (2) electromagnetic radiation (wireless telegraphy), neither involving the use of use of amplifiers. The second period is based on the technology of the de Forest Audion.

For the collector and historian, both those chapters of history are strongly interesting. Early wireless communication gains attraction considering such aspects as the status of scientific theory, the talents of the pioneer inventors, or even chance events of history.

In Brazil, the situation is no different, but there is a scarcity of such artifacts as telegraph keys, spark-gap devices, Leyden jars, crystal sets, etc.

Where does one find such potential museum pieces? Well, locating them is an odd and chancy process: through auctions, antique stores, flea markets, old radio repair shops, and, with luck, Aunt Mary's attic. Another profitable source is old school inventories.

A collection can be organized various ways. A very suitable one is classifying antique artifacts according to the scientific and technical principles of their operation.

The following pictures illustrate some interesting aspects of starting a collection of artifacts from the early days of electronics. For the purposes of a practical historical guide, they are arranged in sequence, considering the major scientific and technological stages of early wireless communication.

Author's thanks to Guy Lietard and Edison de Freitas for letting him use and photograph several antique wireless items from their well organized collections.

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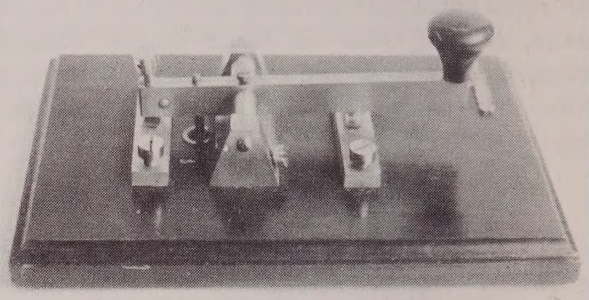
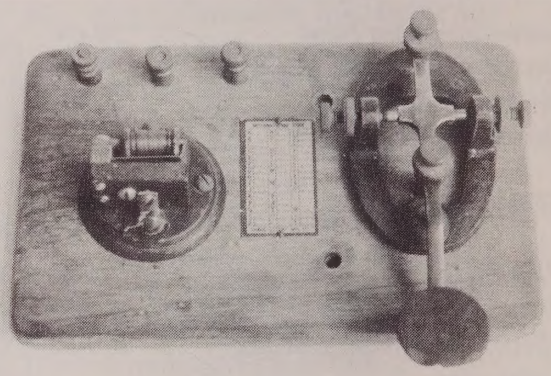
TELEGRAPH EQUIPMENT

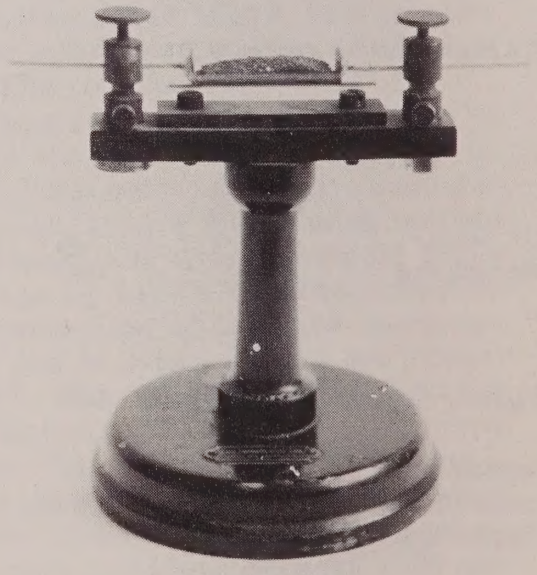


A European-type telegraph key found in a junkyard and restored by the author.



A Morse code learner's set from the early Twenties, popular among young amateurs. Made by the Signal Electric Company.

EARLY HERTZIAN OR RADIO-WAVE DETECTORS

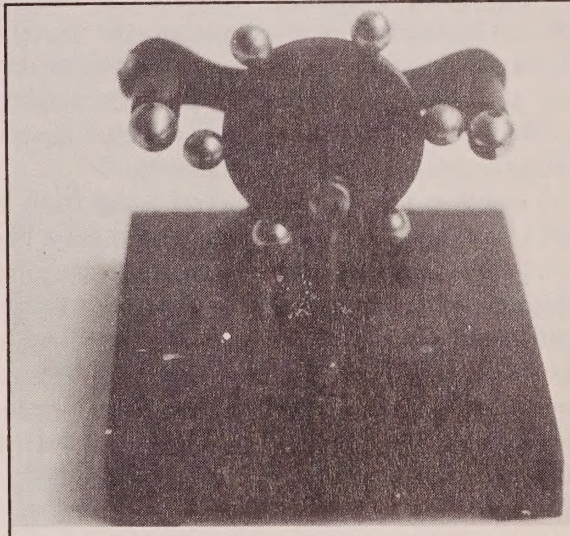


A coherer stand as used for laboratory experiments in the early wireless. The coherer was invented by Prof. Edouard Branly. This is a replica made by the author.

English P. M. ("permanent mineral") detector, new in the box.

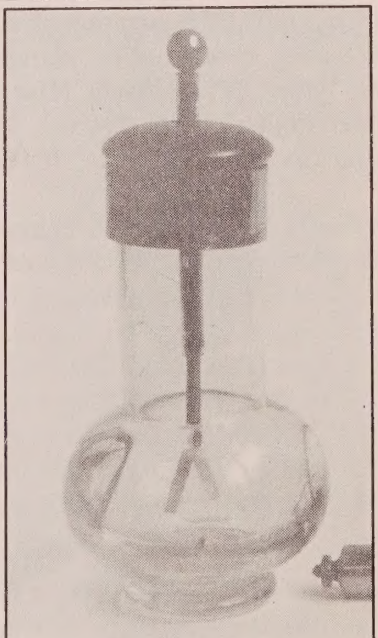
An Italian plug-in galena unit, Detector A Martelleto ("little hammer" or "cat's whisker"), articulo (part no.) 800, ca. 1927.

AMATEUR EXPERIMENTATION



Small rotary spark gap - part of a teaching-aid kit called "School of Frictional Electricity" made in England ca. 1900.

Material for making crystal sets. The book La Réception sur Galène de la Téléphonie sans Fil et des Radio-Concerts ("Reception of Wireless Telephony and Radio Concerts on Galena") was printed in France ca. 1921.



Gold-leaf electroscope used for laboratory physics experiments.

THE MAILBAG

Readers' comments on early radio topics are welcome. Because of space limitations, letters that are published may have to be edited. Send all material to the Editor.

ANOTHER SHOCK HAZARD

Besides power transformers (Aug. OTB, p. 33), another source of HV leakage is a breakdown between the cathode and heater of some tubes. For example: In 1963, I scratch-built a tube-type regulated 0-500 V power supply. Once, while connecting wires to 6.3 VAC screws on the barrier strip, I got quite a jolt. Checking with a voltmeter revealed +500 V on these screws. Further testing revealed it was coming from a cathode-to-heater short in the 6AX4 unregulated B+ and bias rectifier. I replaced that tube with a husky silicon diode and learned a lesson: never mix the heaters of tubes carrying HV into the common heater bus - look at various schematics to see how rectifier and CRT heaters are connected to separate heater windings or even separate transformers.

On another occasion, I put test picks from a VOM to the output of this supply and drew a big arc and blew the supply's line fuse. After changing VOMs, everything was OK - using another meter to check the first one, a Triplett 630, I found a short which was coming from a clip on the range switch. This condition could hold true for the whole 630 family, including the KS-14510 VOM made by Triplett for Western Electric.

Rodney Schrock, KD3OR

NUMBERING OF JAPANESE TRANSISTORS

[To supplement the article on collecting "antique" semiconductors, *OTB* Vol. 27 No. 4, Feb. 1987]: Until 1958 each manufacturer had its own numbering system. For example, Totsuko (later Sony) used 2Txx; Hitachi, HJxx; NEC, STxx; Kobe (later Fujitsu) TEN, 2NJxx. Some US-designed transistors carried the JEDEC number 2Nxxx.

From the beginning of 1958, a new numbering system applied: for diodes, 1S11 and up; transistors, 2S11 and up; phototransistors, 0S11 and up. This system was approved on August 25, 1958, as Japan Industrial Standard (JIS) C7012-1958.

In the fall of 1959, the numbering system changed again. The final plan for transistors was: for PNP RF, 2SA11 and up; PNP AF, 2SB11 and up; NPN RF, 2SC11 and up; NPN AF, 2SD11 and up.

Noriyoshi Tezuka

HIGH VOLTAGE ON YOUR HEAD

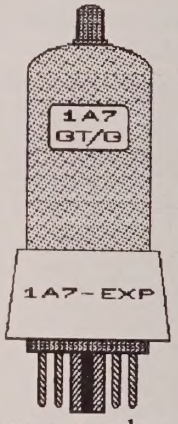
Re: the "All-Star Senior" (p. 42, Aug. '91 OTB): It seems to me that a phone jack with B+ on it is about half of what you need to build a passable electric chair. The other half would be some old fool like me to sit on a grounded metal stool, put on the cans and throw the switch.

Bill Schmitt, KE0XE

[The "Selectosphere" receiver in the October issue has the same killer feature: there is a blocking capacitor in the lower headphone lead, but the volts will sneak around, come out the top jack, and get you. "If using headphones with a cloth cord on a hot day, don't perspire!" It is amazing how casual people were about dangerous voltages in the old days. - LAS]

WHAT IS IT?

Recently, going through my stock of tubes, I encountered these little gems. The one illustrated (in a line drawing which does it poor justice) is seemingly a standard 1A7GT/G. The oddity is this: the bakelite octal base is fitted to a machined bronze (not brass) "shield" which extends from the base upward over perhaps one-third of the glass envelope; it is connected to pin 1. This shield is bored to fit the glass envelope and has tapered sides. It is lacquered. Marked on the shell, in black block letters, is "1A7-EXP." Because of the weight of the tube, it is safe to assume that the bronze shell is solid, not hollow. There are three others: one 6K5-GT (marked "6K5-EXP") and two 1P5-GT ("1P5-EXP").

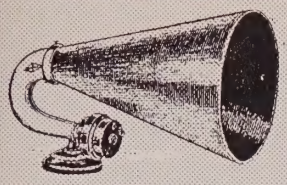


Several questions arise. What does "EXP" mean? I take it as "experimental." One could venture a guess that the 1A7 and the 1P5 were part of an experimental series. Yet, if this is the case, the 6K5 does not fit; it has an entirely different emitter architecture. Who made them? Why? When?

I have had these four tubes for at least 30 years. Vaguely, I remember an acquaintance giving me a number of tubes around 1959-60 with these oddities among them. On test, they all checked 100% (or better) for mutual transconductance, with no shorted elements. So, apparently, they are in excellent condition, both electrically and mechanically. Until recently, I forgot I had them. They may, in fact, be much more than 30 years old; I have no means of ascertaining their actual age. The only thing I am certain of is that they are of American origin.

When I got them, they were wrapped in tissue paper; they were not boxed. Mayhap someone among the membership of AWA has a clue or, perhaps, can make an educated guess.

Rex C. Byle, WA9JWT



THE LOUDSPEAKER

EDITED BY
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All correspondence requires SASE for reply

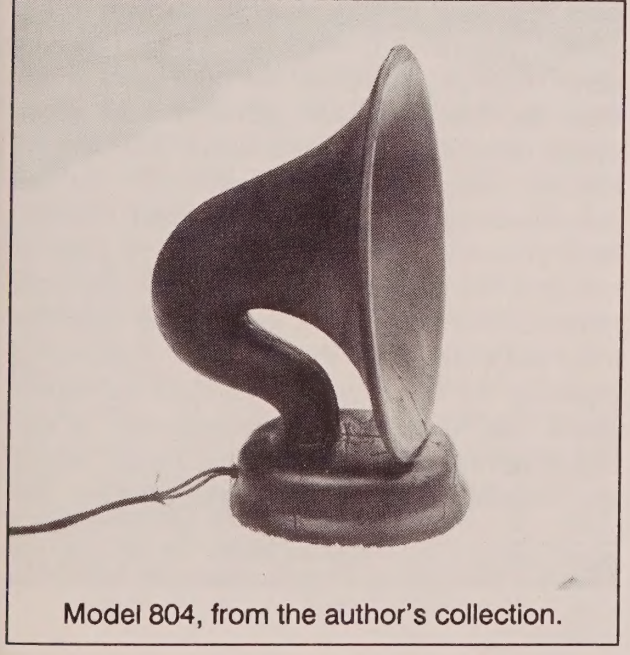
AMERICAN ART MACHE

The American Art Mache Co. of Chicago put out a line of horn speakers in 1922. Their advertisements stated they made their horns of "artificial wood" (wood pulp) and manufactured their product in a die-cast molding press where the wood was treated with pressure of twelve hundred tons per inch and 800 degrees of temperature. They spoke of twenty years' experience as acoustical engineers and manufacturers of papier-maché domes and sound reflectors for opera houses and churches. Magazines of 1922 carried ads of five speaker models. Floral, shell, and harp designs were embedded into the horn bell edges and the designs were colorful. American Art Mache changed its name in September of 1924 to Compressed Wood Corporation. Under the new name, they continued the original line of horns and began adding a few more designs. Ads ran into the latter part of 1925, when their advertising space grew a lot smaller.

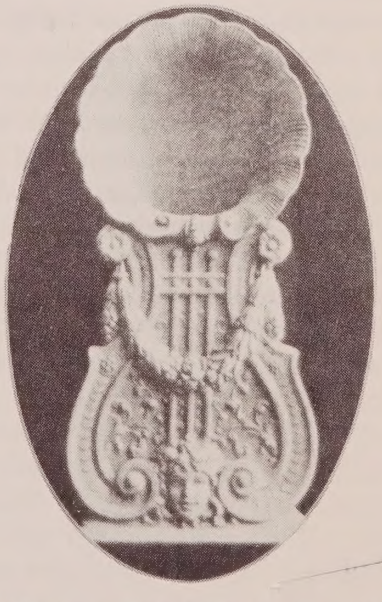
The early model name of "Madera" was used extensively. "Madera Clearspeakers" was also often used. The base support for the upright horn in 1922 changed from a cross-shaped footing to a circular or more "industry standard" rounded base by 1923. Horn markings were typically small decals on or near the base. The prettiest horn was probably the first model made, the 800. It consisted of two pieces. A front façade with an embedded stamping (cast) was the cabinet housing. A horn speaker sat in the cabinet. As such the neck and base of the horn were hidden and only the bell of the speaker rose above and over the façade front. The bell had many small radial lines embedded in the emerging lip.

The models in the table represent the product line.

Model	Description and Price
800	(See text), $25
801	20-½" high, floral pattern in bell, $15
802	23-3/4" high, shell pattern in bell, $18
803	Advertised but not necessarily produced.
804	12" high, squat, bell, neck & base molded in two pieces and glued together.
805	17-½" high, gooseneck with square bell
806	23" high, upright Crystal black or brown, $17.50 Polished walnut, $22.50
807	20-½" high, gooseneck Crystal black or brown, $20.00 Polished mahogany, $25.00
810	Solid walnut cabinet (enclosed), aesthetically pleasing wood grille, ≈ 15" X 9" X 8"
821	23" high, semi-gooseneck, $10.00



Model 804, from the author's collection.



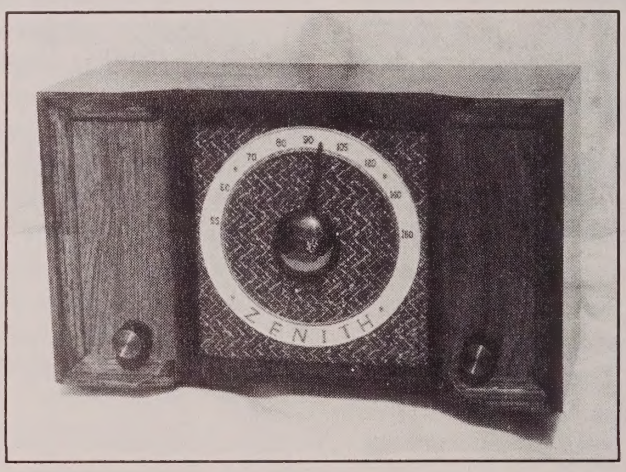
Model 800, from *Radio News*, August 1922.

BIRTH OF A NEW "OLD" RADIO

T. David Zimmermann
120 Ramblewood Pkwy., Mt. Laurel, NJ 08054

Did you ever have an old radio that you wanted to restore to completeness, but to do so would require cannibalizing another - otherwise "nearly complete" or "almost functional" - radio?

Well, this is just the sort of dilemma I faced upon coming to the realization that, to restore my lifelong companion, the Zenith bakelite model 6D815, I would have to buy a whole radio and steal its cabinet for my chassis. My original radio had lost its cabinet in a fall about ten years prior. Following that unfortunate event, a lengthy search ensued which finally ended at the 1988 AWA Conference with the purchase of one of three whole radios that I found. The decision whether to restore the newly acquired radio completely or to steal its cabinet for my chassis was made easy by not only sentimental reasons but also performance. The condition and performance of my chassis was better. As a result, my original chassis (6E05) is now happily enclosed in a cabinet that is even better than the one I knew almost 30 years ago. Happy ending, right? Well, almost. What should I do with that extra chassis? If you're like me, you'd probably want to find a use for it.

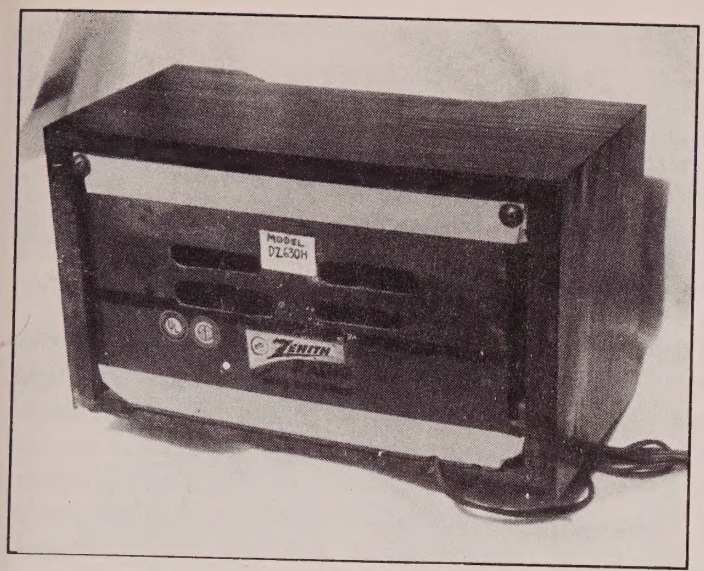


The solution to the extra-chassis problem was made clear when I discovered that my young son was developing an interest in radios. I would design and build a wooden cabinet from scraps I had lying around, place the chassis in it, and give it to him. As the design progressed, however, the level of sophistication heightened the goal to one of making it similar in style to authentic Zeniths but, of course, different from any Zenith ever built - a "one of a kind"!

So I constructed a box using shelf lumber (for the sides), plywood (top and bottom), paneling (front), masonite (back), oak molding (trim), and dowels (chassis guides). Since I own no power tools except a drill, construction of the recessed speaker baffle panel was labor-intensive. I had to use a linoleum cutter and hacksaw blades to cut holes. The holes for the speaker port ended up rather rough but were easily hidden by the grill cloth I had salvaged from an old Philco TV. Mounted on the speaker baffle plate is a circular Plexiglass dial ring which I had cut by a machine shop. Underneath the ring is a paper tracing of the real Zenith dial. Together the dial and tracing circumnavigate the speaker port in traditional style. For the dial pointer I modified a broken one. The original 6D815 had a typical Zenith double point, in this case to indicate wavelength as well as frequency. Since the pointer was broken, I fashioned some decorative bent metal pieces from box staples to fill the space where the second point would be. The lamp which had originally been used as a pilot light has become a dial light mounted just above the dial and behind the grill cloth.

As mentioned before, the chassis performance was substandard. Therefore, to justify all this cabinet work it was deemed necessary to dive in and bring performance up to the level expected of a six-tube AM Zenith. Most importantly, the speaker had the familiar problem of voice-coil-to-pole-piece interference. This was repaired by, first, determining the direction of the rub, carefully cutting the cone away from the basket with an X-acto knife and then gluing cardboard shims between the cone edges and where the cone attaches to the basket. Next improvement was sensitivity and gain stability. Four steps were required: as with many Zeniths which use permeability-tuned IF transformers, migration of silver oxide deposited on the mica discs which form the capacitors was prevalent. As usual, simply removing the IF transformer and cleaning the disc corrected the gain instability.* In this case however, measurements revealed that the input IF transformer was still lossy. A piece of melted solder found on one of the coils may have caused a shorted turn but the problem didn't go away when the solder was removed. I ended up replacing the IF can with a standard Automatic Radio unit. Gain increased dramatically. It also helped to replace the only original Zenith tube in the chassis, a 12BE6 converter having low

* See Bob Haworth and Dave Zimmermann, "Leaky IF Cans in Old Superhets," OTB, Vol. 29, No. 3 (Nov. 1988), p. 25.

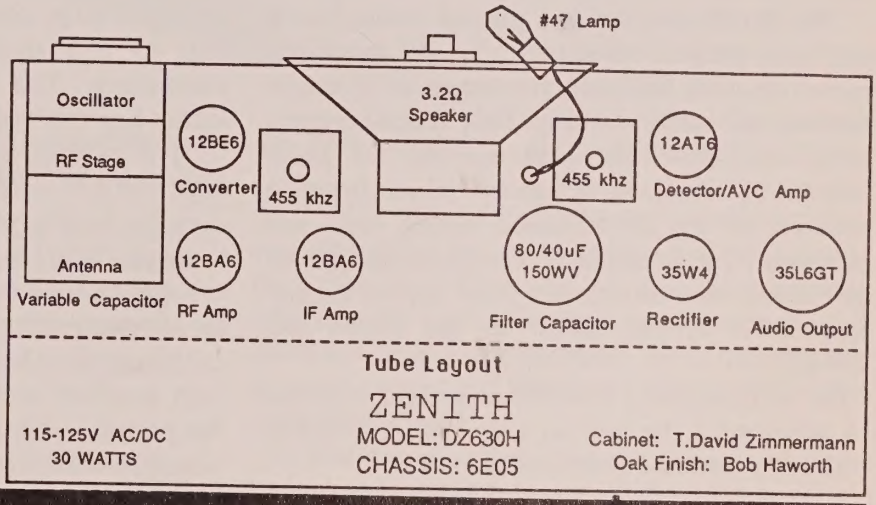


cover. This was a shock hazard. To correct the problem, a cover for the capacitor was fashioned from a cardboard cylinder salvaged from a lantern battery and the top from a 35-mm film can for its cap.

The next and most exciting step was the cabinet finish. For this task, I entrusted the oak veneering and finishing to the adept hands of my good friend Bob Haworth, W2PUA, whose articles on radio restoration appear frequently in these pages. Now it really looks like a radio!

For the finishing touch I mixed new and old technology by using a Macintosh computer to make a tube-layout diagram for the radio. The number chosen for the part number of this one-of-a-kind model falls into the pattern described in my Zenith numbering article in last May's OTB: DZ63OH. The "H" stands for finish: in this case, "Haworth," the master of its finish.

transconductance. The part replacements in the last two steps did not violate the desire to keep things original because, after all, this IS the original. To achieve proper tracking, bending of OSC, RF and ANT outer plates on the variable capacitor and inductance reduction on the loop antenna were both required. Tone quality (bass response) was improved by replacing a leaky 0.05 μF capacitor, used in the loudness compensation network found in so many Zenith chasses. The 6E05 is not of "hot-chassis" design, but the isolated electrolytic capacitor, which is an aluminum FP twist-lock type, had lost its



(Continued from p. 23)

Morgan Wesson reported on planned early showings of the video "Empire of the Air" in the fall, at the Cleveland Art Institute, Cornell University, and University of Rochester. - LAS

BRITISH VINTAGE WIRELESS SOCIETY

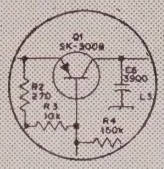
In the BVWS we are very pleased to have American and Canadian members, now amounting to 25 in our total membership of 850. Annual subscriptions for overseas members are £20, but we know that some who might join are put off by the hassle of arranging money orders in £ sterling.

Accordingly, we are quite ready to accept cheques for the equivalent in dollars, but in that case we have to ask for an extra £5 to cover bank charges at our end. At November 1991 exchange rates, annual totals would therefore amount to about $44 US or $48 Canadian. If anyone prefers to pay a subscription for two years at a time, the bank clearing charge would remain at £5, giving two-year totals of $78 US or $86 Canadian.

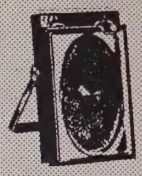
We hope this will encourage US/Canadian membership. Anyone interested in joining should write to Alan Carter, BVWS Treasurer, Lime Tree Cottage, Loxhill, Hascombe, Nr. Godalming, Surrey GU8 4BQ, England. - Pat Leggatt

AWA REVIEW

The new Volume 6 of the AWA Review is available: 182 pages, softbound, with 96 illustrations. Among those is a double-width picture of the famous Eaton collection of WW I tubes, taken before it was destroyed almost 60 years ago. Also, the earlier Vols. 1, 2, 3, and 5 remain orderable. For a full description of what's in Vols. 2 and 6, see p. 5 of the October *OTB*. (For Vols. 1, 3, and 5, p. 6 of the May issue gives a listing.) If you missed out on an earlier volume, now's the time to "complete the set." These make great reading until the flea-market season opens up. They represent excellent value for the cost! Price: $12.50 each, postpaid, in the U. S. and Canada; $14 overseas, from AWA, 44 E. Main St., Flemington, NJ 08822-1224.



TRANSISTOR RECEIVERS



EDITED BY
NORM SMITH
7203 17th Ave. N.W. Bradenton, FL 34209
All correspondence requires SASE for reply

THE PHILCO MODEL T-9 TRANS-WORLD RADIO

By 1958 transistor technology had advanced to the point that it was possible to build receivers capable of reaching up to the 20-MHz range. Zenith, having introduced the transistor Trans-Oceanic, was soon followed by Magnavox, RCA and Philco in building large multi-band sets.

The T-9 was Philco's entry into that field. The receiver is a nine-transistor superheterodyne with seven bands: the 535-1605 kHz broadcast band, plus 2-4, 4-8, 9.4-9.9, 11.4-12, 14.8-15.6, and 17.2-18.2 MHz. This gives some general coverage, plus the 16-, 25-, 31- and 49-meter shortwave bands.

The chassis consists of a printed circuit board with nine plug-in transistors: an RF amplifier, mixer, separate oscillator, two stages of IF amplification, an active detector (not diode-connected!), audio driver and push-pull pair for audio output. A subchassis of hand-wired construction contains all the ferrite-cored tuning coils and bandswitching mechanism. The transistors are all of Philco's own manufacture and are all germanium PNP devices similar to the 2N360 and 2N482.

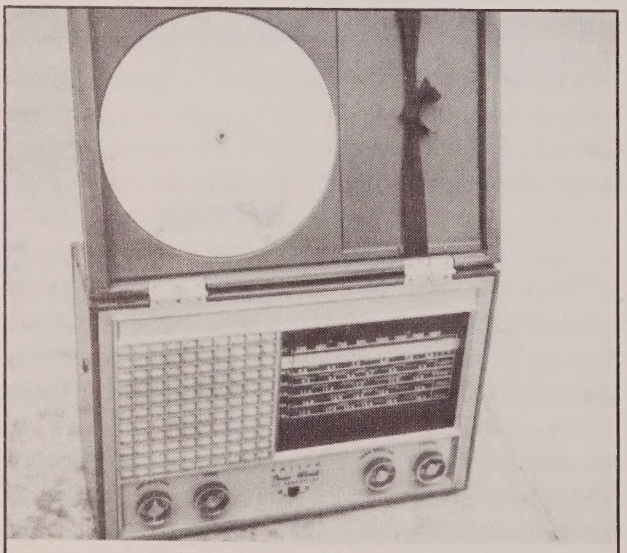
The set includes an input for an external antenna to supplement the built-in whip and AM ferrite rod, and provides a tone control.

One bizarre design aspect involves powering the set. Most of the circuitry runs on four flashlight cells. However, there are two more cells dedicated only to supplying three volts for the oscillator. The designer must have had an ugly problem with feedback from the other stages, probably giving frequency shift on loud audio passages when the batteries ran low.

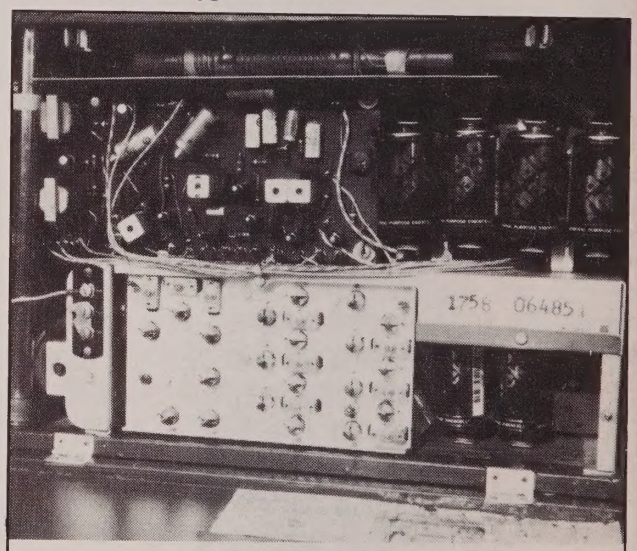
This set has a large and very legible dial which employs a unique slide-rule marking scale which moves to just under the appropriate tuning range as a new band is selected. The tuning is actuated through a large knob on the lower right of the set. This set is a joy to tune, thanks to a flywheel mechanism. This is the finest tuning system this author has ever seen on a transistor radio.

The cabinet dimensions are 16-½" wide, 11" high, and 6-½" deep. Philco used genuine cowhide over the wooden cabinet. The front cover lifts up to reveal the front of the set as well as a large circular world time map, and a compartment to hold the shortwave listener's guide and logging chart.

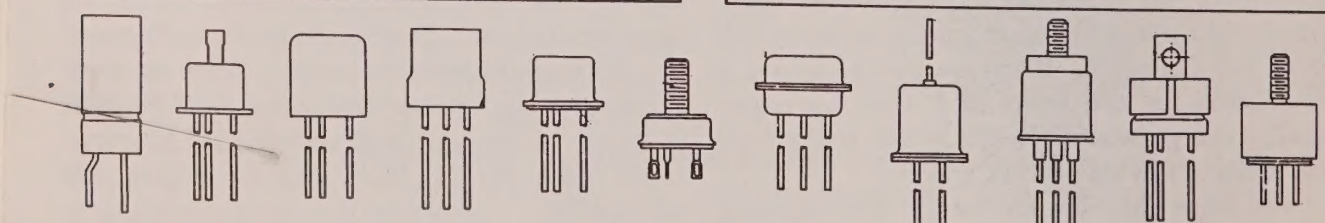
This receiver is an exceptionally hot performer, with excellent sensitivity, as well as plenty of audio power - a worthy competitor for the other Trans-Oceanic type radios.



Front view of the set.



Rear view: board on top, coils below.



THE MISSING LINK

Bill Holly, K1BH
395 Haley Rd, Kittery, ME 03905-5619
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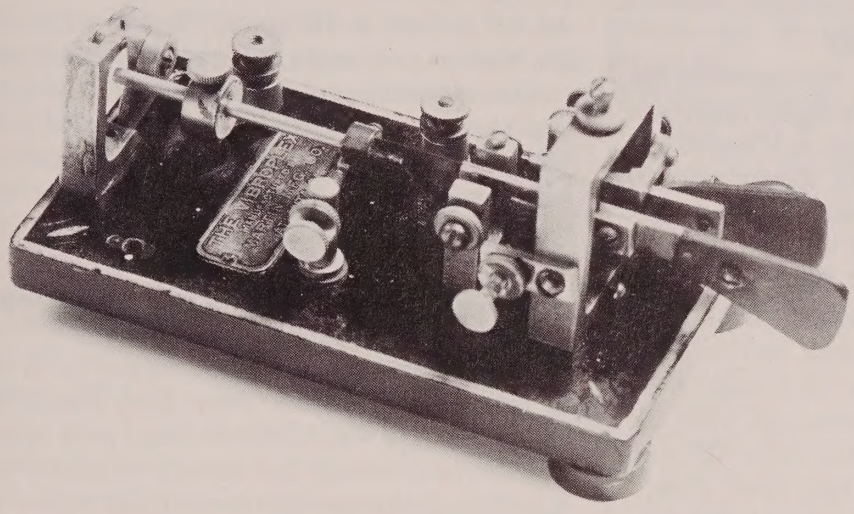


Double-lever key, Martin Mfg. Co. Atlanta, Ga., ca. 1909. *Photos: Michael Mathis, WJ9O*

Chapter 15 of The Vibroplex Co. Inc., 1890 to 1990 mentions a key that had recently surfaced, bearing the nameplate "THE VIBROPLEX - MANUFACTURED BY - MARTIN MFG. CO. - ATLANTA, GA." Because of publishing deadlines it was not possible to get a picture for the book nor to get corroborative evidence to authenticate the key. Since the book's publication, another, identical, Atlanta Vibroplex has come to light. Research recently completed has also helped verify that these are authentic Vibroplex keys by Horace G. Martin.

The photos show the Atlanta key and a close-up detail of the label. A careful side-by-side examination of this key with the Norcross (Georgia) and 1911 model double-levers is by itself enough to convince one that the Atlanta bug is the work of Martin. The label has brass lettering with black filler and the size, shape, and general style are nearly identical with the 1907-08 Norcross label. The top parts of the Atlanta key are nickel-plated and have the same size, shape and placement as those on the 1911 model. The only major difference between the Atlanta and 1911 models is the way the dash levers are mounted; this difference appears to be a logical evolutionary change to simplify a milling operation.

In TVCI the demise of the United Electric Co. Inc. of Norcross in August 1908 is noted, as is Martin's reappearance in New York City in 1911, but the years 1909 and 1910 remained a mystery. Thanks to the Atlanta key itself and recent correspondence with Anne Price of the Atlanta Historical Society, Martin's whereabouts and activities during 1909 and 1910 are no longer a puzzle.

Copies of entries from the 1909 and 1910 Atlanta city directories, furnished by Ms. Price, reveal that Horace G. Martin, his wife and his son, Horace Jr., had moved only a few miles down the road, from Norcross to 580 Whitehall in Atlanta. In the 1909 directory, Horace Sr. is listed as a "mfr" (manufacturer) but in the 1910 he is shown as an "opr" (telegraph operator) for the Associated Press.

It would appear that after the U. E. M. failure he moved to Atlanta to manufacture Vibroplexes under his own label. It would also appear that sales were not brisk enough to support his family and Martin Sr. was forced to revert to his old trade of telegrapher. It is probable that it was during this period that J. E. Albright contacted him and made the offer that brought Martin back to New York.

[The complete history of the Vibroplex Company is contained in the author's book cited above and reviewed in last February's *OTB*. It is available from the author or the Vibroplex Co. Inc. (1-800-AMATEUR); price $19.95 plus postage and handling.]

Nameplate from this key.

KEY and TELEGRAPH

EDITED BY
LOU MOREAU
W3WRE

THE STORY

"During the tragic Civil War between the states, the telegraph played a highly important role. President Lincoln frequently visited the telegraph office of the War Department to keep abreast of developments. One of the official operators was Jesse H. Bunnell. Letters of an officer attached to Lincoln's staff tell how the president would quietly perch himself on a corner of Bunnell's desk and listen in thoughtful fascination to the click-clack of the sounder as it tapped out messages from the Union forces. Then he would ask softly, with anxiety in his eyes, "Anything new, Jesse?" After the war, Bunnell established the company manufacturing telegraph instruments under his name."

- OTB story files, not printed

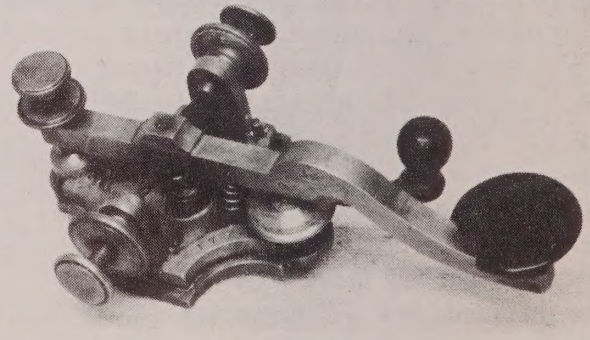
- Bunnell Co. promotional

Q: I have a question about some of the old-time Bunnell advertisements. According to them, Jesse Bunnell was one of the operators "in the White House" during the Civil War. Is this true? If so why did the company begin telling it in its 1950s catalogs? Why not earlier?

A: That advertisement is not true, but it does make a good story and, unlike you, many people are credulous enough to believe it. This is one of the many legends of the telegraph that is based on nothing. As a matter of fact, the teenaged Jesse H. Bunnell was indeed an operator with the Military Telegraph during the Civil War but, so far as can be found, was never assigned to the telegraph office - that was located in the War Department, not in the White House. Rather, in May 1861, he was first stationed at Annapolis. In June he was General McClellan's telegrapher; in the fall of 1861, at Hampton, Virginia. Then, in the Western campaigns, he operated with various commands ending as Office Manager for General Sherman in Atlanta. He left the Military Telegraph in 1864. At no time was he working with the men in the War Department nor was there one in the White House. Of course, that "Anything new, Jesse?" makes a good tale, and no doubt sold some equipment in the Twentieth Century, but it is only a legend. Sorry.

Another legend that has just popped up in one of the new publications about keys claims that James Leonard was the first to read code by ear. This is not true and has already started a new false legend that should be corrected before everyone begins to believe it because "it was in a book so it has to be true." The truth is that Jimmy Leonard was one of the first to participate in a test to prove the value of the Morse system in Paris in 1855. It is also true that he was a teenager at the time and that he copied at the rate of 55 words a minute off the wire, but that was just a special demonstration.

According to the Morse Journal, the first recorded instance of sound reading was in 1846 in the Magnetic Telegraph Company office in Washington, D. C. Morse and the operator, a Mr. Washington, were chatting when the office sounder began to click. Mr. Washington called back on the wire, asked a question and told Morse the answer. In his Journal, Morse recorded this example of the ability to read by sound as well as by paper-tape recorder. This incident is recorded in the Morse Journals, Vol. 2, pages 479-480, to be exact.



Atlantic & Pacific Telegraph Co. Camelback, 1850. These keys lacked a provision for spring-tension adjustment until 1860. *Photo: W3WRE Collection.*

ALIGNING SUPERHETERODYNE SETS

Ross Smith
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Edited by Serge Krauss. Reprinted by courtesy of *IHRS Bulletin*

With a little practice, you can become proficient at aligning superhet broadcast radios by following a set of basic instructions. If you can find the factory procedure or service chart for your set, it is best to stay with its recommendations. If not, the following outline may be used with good results.

Before beginning the alignment, restore the circuit to good operating condition. Outlines for circuit restoration are available in many books and bulletins, including "Circuit Restoration by the High-Impedance Power Supply Method" (*IHRS Bulletin*, Vol. 18, No. 2, p. 4, reprinted in *OTB* Vol. 30, No. 4, p. 18) and "Restoring AC-DC Receivers" (*OTB*, Vol. 31, No. 2, p. 34).

IF ALIGNMENT

Align the intermediate-frequency transformers first. You will need an audio-modulated RF signal generator with dependable frequency calibration and low harmonic output. You will also need a signal-output indicator, such as a high-impedance DC VTVM for sets with automatic volume control (AVC), or an AC millivoltmeter to read output from the voice coil of the speaker. You will also need a variety of alignment tools, as covered below. Depending on the age of the radio, you will find IFs of 130 kHz, 175-181 (175), 262.5-264 (262), 370 or 448-485 (455, 456 or 465). 455 kHz is the standard for the later sets.

If the frequency is unknown, you will need to scan the above frequencies with the generator in order to find it. Be careful to avoid mistaking a harmonic from the signal generator for the fundamental: start at 500 kHz and work *down*.

A "screwdriver mechanic" may have turned trimmers 'way off frequency. If so, it will be necessary to "chase" the resonance back to the correct value. In such a case, find a peak reading by rocking the signal generator, then alternately de-tune the generator toward the correct frequency and readjust the trimmers to peak. Keep repeating until you arrive at the correct frequency. For example, I recently had to "chase" a set from below 400 kHz all the way up to the correct 456.

SUGGESTIONS FOR IF ALIGNMENT

1. Connect a VTVM between ground or neutral and the AVC line. You will be reading a maximum AVC potential of -5 to -30 volts DC. Caution: with AC-DC sets having one side of the AC line connected to the chassis ("hot" chassis) you must use an isolation transformer or be sure - *very sure* - that the ground side of the power line is connected to the chassis by a neon-bulb test. Neutral ground for many of the later AC-DC sets will be on a power-switch terminal, floating from the metal chassis. *However*, without an isolation transformer the circuit will be "hot" with the switch off.

You can often find the negative AVC voltage on the high end of a volume control that is not blocked by a capacitor, on the grid-return circuit from IF or RF tubes, on the grid of an eye tube, or on the grid-return (low) end of the antenna loop. Look at the schematic to find the grid-return points in the AVC circuit. If the set was made before the mid-1930s, it likely does not have an AVC circuit and it will be necessary to take the peak readings by an AC voltmeter in parallel with the speaker voice coil. If no meter is available, a less precise adjustment can be made by listening to the sound level from the speaker.

2. Connect the signal generator to the input of the IF stage. Locate the converter (first detector) tube and connect the generator probe directly to the grid through a small fixed capacitor, such as a disk or mica capacitor between 200 and 470 pF. Connect the ground side of the generator to the circuit ground or chassis of the set. For a converter tube with a grid cap, remove the cap clip and connect a 470K resistor from the cap to ground or neutral; then attach the series capacitor between the generator probe and the grid cap. Tune the radio to the low-frequency end and do not connect an antenna during the IF alignment.

On simple sets with no RF stage and no IF trap in the antenna circuit, it is often possible to feed the IF generator into the antenna terminal. When you hear the generator signal, turn the radio tuning dial to make sure you are not tuned to a harmonic: turning the dial will not tune out a correct IF signal. It is best to keep the radio dial at the low frequency end, tuning away from any signal incoming from the air. For an AC set with a separate oscillator tube, pulling the tube will prevent interference from radio stations.

3. Alignment operation: Set the modulated signal generator to the IF frequency. Turn the volume control up and tune the signal generator output as low as possible while still hearing the signal. Turn the trimmers (or iron cores) to peak output, starting with the input (first) IF transformer. Continue to reduce the signal-generator output to a minimum for peak readings. This requires turning the scale lower (more sensitive) on the VTVM indicator. Continue down the line with the second IF transformer (if present) and then the last (output) transformer. Go back and

re-adjust the first IF transformer. On some low-priced AC-DC sets of the 1930s, the output transformer feeding the detector circuit has only one trimmer. Other sets of this era may have one transformer, or both, mounted under the chassis with no shield can. In this case, the trimmers are nearby, in pairs, on the side of the chassis.

If you cannot find the IF signal with the generator connected to the converter-tube grid, move the connection over to the grid of the first IF tube. Align the second (output) transformer and then go back to the first (input) transformer.

As you reach the final peak adjustment, the signal generator will be at a very low level and you will hear background "hiss" and noise off the air. This is a sign of good circuit gain.

NOTES ON IF LINEUP

A. If you encounter oscillation, feedback or regeneration, such as heterodyning at the peak adjustment of the trimmers, you may have a circuit fault. Check the bypass capacitors in the AVC, screen-supply, and plate-supply circuits; and even the electrolytic filter capacitors. This is done on a cut-and-try basis by paralleling a 0.047-μF 600-V capacitor from these leads to ground or neutral. For the electrolytics, try paralleling a 0.1-μF cap. Also, look for a missing or ungrounded tube shield on the RF, converter, IF, or detector tubes. Substituting an unshielded glass tube for a metal tube could cause this problem. Also, look for an open grid circuit.

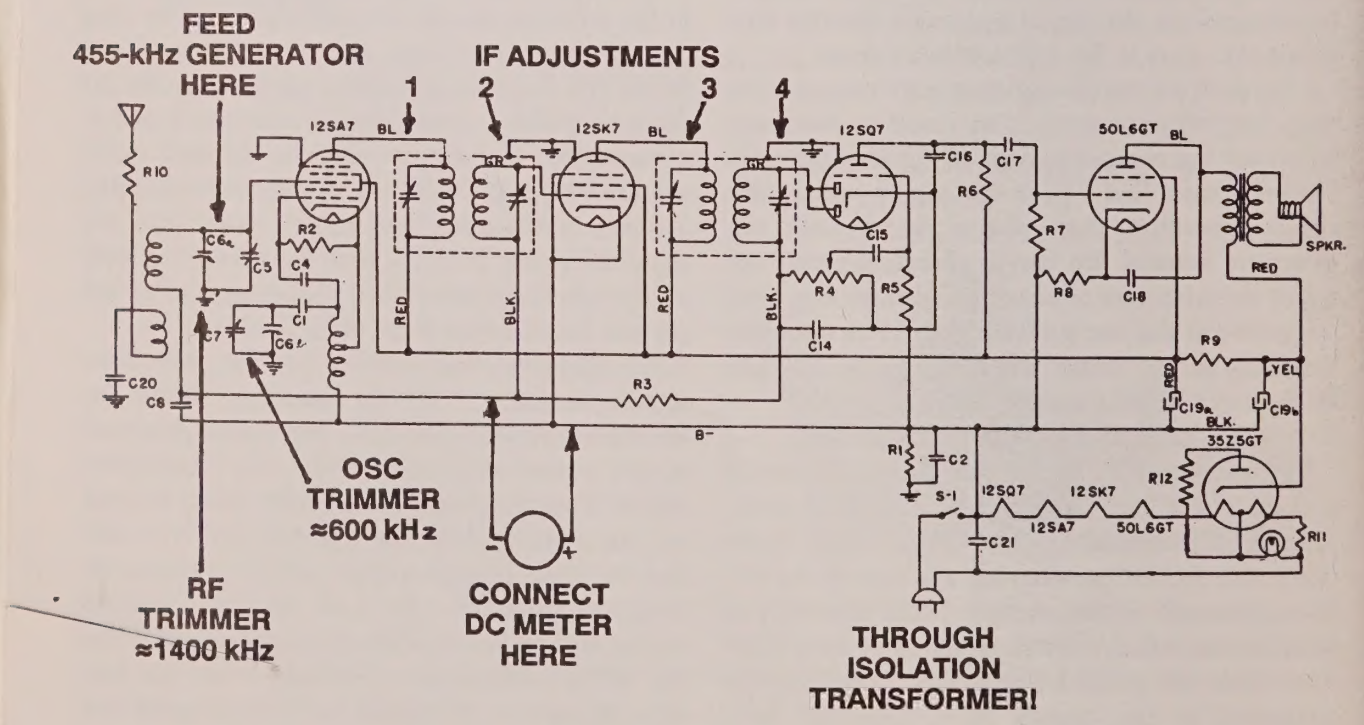
B. If the radio has been in a damp area and the coils have absorbed moisture, drying them with a hair dryer may bring them back to life. Occasionally an IF transformer is defective and must be replaced. I can remember only one occasion when *both* units had to be replaced. Be sure to replace a defective transformer with an "input" or "output" type of the same frequency.

C. Caution on IF transformers made before the mid-1930s: the screws on some trimmers were not isolated from the transformer circuitry and are "hot" with B+ on the plate side. An insulated tool should be used. If you use a metal screwdriver, tape the end so that it will not short the "hot" screw to the metal transformer can. However, a metal driver may de-tune the circuit, especially on the grid side, making it difficult to set to the peak position. If the trimmer screws are frozen, try a small amount of WD-40 or light oil and let soak overnight.

D. Tools: A wide variety of alignment tools is needed for sets of all ages. More recent sets use the plastic hex rod drivers that are available at electronic stores. Some transformers of the early 1930s have tandem screws and hex bushings that require the old-style plastic hex drivers in 1/4" and 5/16" sizes. Look for these at a radio swap meet or try to obtain them from a serviceman from that era. Most single-slot screw trimmers can be adjusted with a metal screwdriver. If not, use a plastic driver with a metal blade insert in the end. My best tool of this kind is a Signal Corps TL-207.

RF ALIGNMENT

Let us begin with an ordinary five-tube broadcast-only radio that does not have a padder variable capacitor for peaking the low-frequency end of the band. There will be two trimmer adjustments, normally located on the two-gang tuning capacitor. A few early sets from the 1930s, with an antenna coil and a permanently attached an-



tenna wire, have a third trimmer for peaking the antenna primary circuit. In this case, the antenna wire must be uncoiled to full length before peaking the trimmer. Most of the later sets have a loop antenna connected directly to the grid of the converter or RF-amplifier tube. The loop trimmer is located on the converter section of the tuning capacitor or on the loop assembly.

SUGGESTIONS FOR RF ALIGNMENT

1. Place a large knob on the tuning shaft, for ease in rocking the dial back and forth during adjustment. Be sure that the dial pointer reads correctly at its extreme clockwise and counterclockwise positions.

2. Let the set warm up for ten minutes or so.

3. Set the RF trimmer. With the output indicator or AVC meter connected, tune to a station around 1400 kHz. Note the output level, the station frequency and the tuning-dial reading. Adjust the antenna trimmer for peak output.

4. Set the oscillator trimmer. Tune to a station at the low end of the dial, around 600 to 700 kHz, that gives enough signal for a good output-meter reading. Note the station frequency and the dial reading, which may differ. Now "chase" the maximum-output point by alternately rocking the dial clockwise and CCW while turning the oscillator trimmer slowly. By tightening the trimmer screw, the dial reading at maximum will be higher; by loosening it, lower. Try one way, and as soon as the signal decreases, turn the other way for peak output. For best stability, approach final adjustment of the trimmer in the tightening direction. You will be surprised at the added volume at the low end of the dial from making this adjustment. Again, note the station frequency vs. dial reading. They may not be the same.

The oscillator trimmer will be located on the oscillator section of the tuning capacitor, which is the smaller section having fewer plates. Older sets may have equal-sized sections. In this case, you may find the oscillator section by placing your finger on the stator plates, which will change the frequency and de-tune the station or even pick up another station. Touching the antenna-section plates will only reduce the output.

5. Reset the RF trimmer. Go back to the first high-frequency adjustment and re-peak the antenna trimmer. Note the station frequency vs. dial reading. The dial pointer may need to be moved for correct dial calibration and maximum output at this point.

6. Reset the oscillator trimmer. Go back to the low end and re-peak by using the rocking operation. If the dial is off calibration, see if you can bring the station frequency closer to the dial reading and still have maximum output.

7. Always re-peak the high end after a low-end adjustment. You may have room to arrive at a good compromise of low- and high-end calibration. If not, set the correct calibration at the high end and let the low end fall where it may.

8. Early sets with series padder capacitors in the oscillator circuit are more flexible and easier to calibrate at the low and high ends of the dial. The procedure is the same, except that the padder is used for peaking the low-end frequency instead of using the oscillator trimmer. Use the oscillator trimmer for the high-end adjustment only. Going back and forth between the low and high ends a couple of times will fine-tune the alignment. It is rarely necessary to move the dial pointer from the end-point stops on sets with padders.

In order to identify a set using the series padder, observe the schematic of the oscillator circuit or look for it on the chassis. It will be a large, usually square or rectangular, multi-plate mica-type ceramic-base trimmer mounted on the inside of the chassis.

9. For large sets with a tuned RF stage and three-gang tuning capacitor, there will be three trimmers on the capacitor or inside the chassis. Set the antenna and RF trimmers together, using the same procedure as for the two-gang capacitor. Oscillator peaking is also the same.

NOTES ON RF LINEUP

A. Mark the position of an unknown trimmer before turning it. If no increase in gain is noted, return it where it was. It may be for another adjustment such as short wave or an IF wavetrap.

B. A quick check for loop-antenna sets: tune to a station on the high end of the dial and place your fingers on the loop antenna. This should cause a *decrease* in gain from the added hand capacitance. If you have an increase, try the RF alignment again!

C. If the radio (Scott, Zenith, Silvertone, etc.) has variable selectivity for high fidelity, place the selectivity switch or variable adjustment on the "sharp" or narrow-band position during alignment.

D. An RF signal generator may be used in place of a radio station, with care to avoid harmonics or heterodyning with radio stations.

ALIGNMENT OF SHORT-WAVE BANDS

For short-wave alignment, original manufacturer's instructions are strongly preferred. Due to the many and varied short-wave band circuit designs, it is impractical to suggest a universal method. As an example of the variations, some Zenith circuits of the mid-1930s having three-gang tuning capacitors use the Section 3 antenna trimmer for peaking short-wave at 15 MHz. The Section 2 (center) trimmer is used for peaking the broadcast band at 1600 kHz, and the Section 1 trimmer is for oscillator alignment. All other trimmers for short-wave, and the broadcast padder, are inside the chassis with holes for adjustment from the outside.

THE "ULTIMATE" LIST OF HEADSETS

The May, 1988 OTB carried a list of 77 models of headphones collected by Jim Sargent, WA5QBR. The listing closed with the challenge "can anybody add to this list?" Well, sure enough, Vince Highmark, W0EVD, came forth with another lengthy set. So did Vernon Kostohryz. It seemed natural to merge all these lists, plus listings from a pair of mid-Twenties manufacturers' directories [1] that appeared about the time the demand for broadcast-listener headsets peaked.

The OTB has printed Bro. Pat's list of 450 or so brands of 201A tubes. The next page starts the "headphones" equivalent of that list! In this tabulation, items marked with asterisks are known to have been advertised but were not reported by the collectors as being in their possession.

In assembling this list, we have not edited out variations in names of models or companies, on grounds that it may be of historical value to include such variants. We see the results of shifting distributorship agreements and changing company names.

There are some interesting entries here. Many of the old-time telephone makers are represented (American Bell, Automatic Electric, Century, Chicago, Couch, CTE, Holtzer-Cabot, Kellogg, Leich, Monarch, and so on), along with the later "radio" manufacturers and jobbers. The names of the headsets reflect their market "positioning": if being sold to the serious amateur or professional wireless operator, they carried staid labels like "Type C," "No. 55," or "Navy Type"; if being promoted to the mass broadcast-listener market, they bore more spiffy names like "Violana," "DX Special," or "Little Spitfire."

The list includes watchcase telephone receivers generally having low impedances of the order of 75 to 100 ohms. These were used widely in home and apartment-house intercom systems. In the old days when telephone companies were allowed to provide telephones, they sometimes supplied watchcase types as second receivers on candlestick telephones [2]. This let the user apply both ears on a long-distance call or have a stenographer record the conversation.

Telegraph operators used low-resistance single headsets as "silent sounders" for, for example, the Morse order wire to a broadcast remote-pickup point. The radio engineer wore the sounder so that Morse clicks could not disturb the audience at the pickup site.

The collectors reported at least six makers of the wartime ANB (Army-Navy-British) H-1 receiver. This is an item of interest technically. Earlier designs, dating back to the early development of the telephone, used simple flat diaphragms that resonated strongly around about 1000 Hz. This gave extra sensitivity. The resonance gave a filter action that was quite helpful in copying CW in the presence of static and QRM, but that gave dismal fidelity for speech or music. One modern measurement on a set of Baldwins gave about 28 dB less output at 1050 Hz than at 900 or 1600 [3]. The ANB H-1 was an acoustically correct design by Bell Laboratories [4] that provided smooth, flat response across the voice band. It thus reduced user fatigue and improved the understandability of voice signals. It was a low-impedance design for use with modern equipment having no need for extreme sensitivity.

Resistance or impedance figures are included in the list where they are available. Unfortunately, the AC impedance of a headset is typically five to ten times the DC resistance. With the old-time resonant designs, the impedance varies wildly with frequency. Collectors using an ohmmeter will measure only the DC resistance. Advertisers were quite casual as to the difference between the two figures, and rarely specified the frequency of measurement.

We also see possibly a bit of sales hype in the resistance figures: in the early days, the theory was promoted that the higher the resistance, the higher the sensitivity. This was perfectly obvious to anyone who tried to use, say, a 75-ohm telephone receiver on a one-tube receiver. Within limits, going to a high-resistance headset gave much better results. As a result, a given maker might offer a normal 2200-ohm headset, plus a 3200-ohm version at a 30% price premium. However, the higher values of resistance (above 1000 ohms per receiver) are suspect: the old story is that getting high values of resistance simply involved winding the coils with resistance wire. After all, to make a 1000-ohm (DC) receiver with even super-fine (44-gauge) wire requires cramming about 200 feet of wire into each of the two windings. It would be informative, if destructive, to open up a few "2000-ohm" receivers to see if

the wire is in fact copper.

For purposes of repairing headsets, one old-time source [5] reported that receiver caps were interchangeable among certain families of headsets. The listed groupings were: Trimm Acme, Trimm Rex, Trimm 607, and Frost; Trimm 604W, Trimm 604K, and Western Electric 528; old Rex, Little Spitfire, and Frost 174; Cannon Ball, Crosley, and Federal 53-W; Cannon Ball Empire, Cannon Ball Dixie, and American Bell; and all Brandes models. (No claim is made that the external details are the same from one headset to the next.)

The collectors who contributed to this article report success in storing their treasures in zip-up plastic bags. This organizes the headbands and cords to prevent snagging. [LAS]

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[1] The Radio Trade Directory, McGraw-Hill Co., Inc., New York, May 1925 and 1926 (the latter reprinted in the Dec. 1977 OTB).

[2] "Substation Apparatus - Auxiliary Receivers, #146 Type," New York Telephone Co. Engineering Bulletin 389, Aug., 1923.

[3] F. A. Paul and B. Rogers, "Nathaniel Baldwin Earphones," OTB, Vol. 24, No. 3 (Dec. 1983), pp. 21-22.

[4] M. D. Fagen, ed., A History of Science and Engineering in the Bell System - National Service in War and Peace (1925-1975), Bell Telephone Labs., Inc., Murray Hill, NJ, 1978, pp. 209-211.

[5] E. G. Osterhoudt, "Headphones: Operation and Repair," Modern Radio Laboratories, San Carlos, CA, 1948, p. 10.

Acme Specialty Co., The Acme
Advance (*) Radio Manufacturing Co., Chicago
Aerial Service Corp., ASCOR
  (single)
Airline Radio Deluxe, bakelite
  single 2K
  double 3K
Airline Radio Special, alum. 2K
Airline Special
  Radio Headphones (*)
  Lakeside Electric Works, Chicago, 2K and 3K
Ajax Electric Specialty Co. (*), St. Louis
Allied Radio Corp., Chicago, American Bell 2K
Allied Radio Co., Lincoln, 2.4K
Ambassador Sales Co., NY(*)
J. H. Ambrose Co., Penn Yan, N. Y., JACO, P. U. T. 2K
American Bell Telephone Co.
  (watch-case receiver)
American Bell, see Allied Radio and Wayland
American Electric Co., Chicago
  Army & Navy Type
  Keystone (*)
  Swedish-American (*)
  Victor (*)
American Electric, 90B (single)
American Mechanical Laboratories, Brooklyn, AML (*)
Ampl-Tone - see French and United
Aristocrat (*) - see Dictograph
Army and Navy - see American
Atlas Adjustable - see Electric Products Co.
Atlas Multiple - see Electric Products Co.
Auth (Electrical Specialty Co., New York)
Auth
  N. Y. 2.2K
  2K, name on band only
  Pat. 2K
Auth Elec. Co., N. Y., Roycraft Tested Headset 2.2K
Automatic Electric Co.
Automatic Elec. Co., Chicago, Automatic 1.5K
Baldwin, Salt Lake City, Type C
  aluminum diaphragms (single and dual)
  fiber diaphragms (two variations) 1.5K
  mica diaphragms 1.5K
  mica diaphragms (two sizes) 2K
Barawik T770 2K (*)
BASCO, Briggs and Stratton 3K
Bel-Canto (Bel-Canto Radio and Tel. Eqpt. Co, New York) (*)
Benwood-Linze
Ben Franklin - see A. P. Merchant Co.
Ben Wolfe Electronics Corp., Ambassador
Berkey Test-Fone
Berstan (*)
Berwick - see Triangle
Best Mfg. Co., Best (single)
Best Mfg. Co, Irvington, NJ, Receiver ANB H-1 300 Ω
Bestone - see Hyman
Bethlehem Electrical Co., Newark, Splitdorf 3K
Big Three Radio Corp., NY (*)
Big Three - see Clearphone
Blue Streak 1.2K
Brandes
  (small model with ball-socket headband connection)
  (early model, "Superior" on wide nickeled band)(*)
  Admiral Matched Tone 3K
  Navy Type Matched Tone
  Superior
  Superior Matched Tone
  Superior Matched Tone ("Brandes" boxed in engraved border)
  (as above, aluminum caps)
  Transatlantic (*)
C. Brandes, Inc., NRI
C. Brandes, Inc., N. Y.
  (early model) 2K
  Admiral 2K and 3K
  Navy Type 3K
  Superior (three variations) 2K
  Superior (alum. caps) 2K
Branston (*) (C. D. Branston, Buffalo, NY)
Briggs & Stratton Co., Milwaukee, BASCO 3K
Brown Type D 4K (*)
S. G. Browne, Type F, London
Brush crystal, high-imp.
  single and double
  Clevite by Murdock (later)
Brunet et Cie., Type F, Paris
O. Brunet (French)
Bunnell
Cannon & Miller Co., Springwater, New York
  Dixie Cannon Ball 1.5K
  Cannon Ball 2K
  Camco 2.2K
  Camco Grand
  Camco Cannon-Ball

C. F. Cannon, Springwater, N. Y., Cannon Ball Alnico #15 2K
C. F. Cannon
Alnico Magnetic #15, 1K single and 2K dual
Cannon Empire
Cannon Chief
Cannon Scout
Cannon Ball
Dixie (small and larger cases)
Junior
Master 2.4K
CGE, Canadian GE, Made in England 4K
Century Tel. Construction Co.
Telephone Type CX(CZ?)-159
Model SC (single)
F. B. Chambers & Co. (single)
Charles E. Chapin
Chicago Telephone Supply, DX Special 20K
Churry Mfg. Co., Detroit, Churry (*)
CIC - see Connecticut
Clarion - see Radio Supply Co.
Clearphone Radio Corp., Big Three
Clearphone Co., Stamford, Conn., Solid (Pat'd 6/1/1909)
Clear Phone, Clear Phone Co. (watch-case receiver)
Coherer Products (also see Racon)
Connecticut Instrument Co., Stamford, CT, CIC
Connecticut Tel. & Elec. Co., Meriden, Ct. (phones and watchcase receiver)
Connecticut
(single)
200 Ω
R-2-A
Consolidated Radio Products
Consolidated Radio Products Co.
R-2-A 2K
R-14 2K
HS-16-A, 150 Ω
Chas. Cory & Son, Inc., Coryphone
Chas. Cory & Son, NYC, Coryphone Radio 2K
Couch 4660 (watchcase) (bakelite case)
S. H. Couch Co., Inc., 4660 (watchcase)(brass case)
S. H. Couch Co., Inc., Boston, Couch 3K
Crosley
Crosley, 2500 Ω
Crosley, Cincinnati 2K
C T E [Conn. Tel. & Elec. Co.] P/O H-3/ARR-3 30 Ω
Davis (bakelite)(*)
Davis - see United
DECO
De Forest Radio Tel. & Tel. Co.
De Forest Radio Tel. & Tel. Co., Jersey City, De Forest 2K
Delta Electric Co., Marion, Ind.
Delta 4K
Gold Stripe (*)
Delta Electric Co.
Deluxe - see International
Dependable - see Trimm
Deveau - see Stanley & Patterson and Solid
Dfh.b - 44 (German?)
Dictograph, CDC-49016
Dictograph Products Corp., N. Y.
Aristocrat 3K (*)
Dictograph R-1 3K
Dictograph R-3 3K
Dietzen 2.2K (*)
Dietzen Navy Type 3K (*)
D-H & E Co., S-C No. 2-AK
DLR No. 2 S
DLR No. 5 - ITBA5
Durophone - see Warren
DX Special - see Chicago
Dymac - see Electrical Products
D/T/W (logo) w/vol. cont. 4K
Durophone - see Warren
Eastern (*) (Eastern Electric Co., Elizabeth, NJ)
Edeson Radio 3K
Eisemann
Electric Products Co.
Atlas Adjustable
Atlas Multiple
Electrical Apparatus Co., Detroit (*)
Electrical Products Mfg. Co., Providence, R. I., Dymac Type E 2.4K
Electro Importing Co. (single)
Electro Trading Co., N. Y.,
Berwick Supreme (single) 1.1K (also see Triangle)
Elwood (Elwood Electric Co., Newark)
Elwood, Bridgeport, Conn. single 1K and double 2K
Ericsson, Societe' des Telephones, Made in France 4K
Essex (*)
Everett
Everytone (*) - see Pacent
Excello (*) - see Rex
Featherweight Twin Tone
Featherweight Twin Tone, New
Federal Tel. & Tel. Co., Buffalo, N. Y., 52-W 3.2K 53-W 2.2K
Federal-Brandes, Inc., Newark, Brandes (also see Brandes)
John Firth & Co., NYC, Made in Germany (vol cont) 2K
John Firth & Co., Made in Germany ("SEIBT" stamp) single and dual)
C. M. French Mfg. Co., Ampl-Tone
Friedlander-Koppler Radio Service, N. Y., Welbilt (*)
Frost Fones (H. H. Frost, Chi.)
No. 161 2K
No. 162 2K
No. 163 3K
No. 171 3K
No. 172 3.2K
No. 174 2K
No. 175 3K
GEC (GECOPHONE) Reg. No. 691375 (BBC Stamp)
Gemphone - see Radiogem
Gem Earphone Co. (hearing aid)
General Radio Company, Limited, London, General Radio (BBC Stamp)
Globe Electric Co., Globe (single)
Globe, Globe Phone Mfg. Co., Reading, Mass. (alum., w/pic of globe) 2.2K
Globe, Reading, Mass. (plain)
Gold Seal - see Stanley and Patterson
Gold Stripe (*) - see Delta
Gold Tone (*) (Gold Tone Radio Co., New York)
Goldschmidt Corp., New York (importers), N & K (*)
Gundlach-Manhattan Optical Co., Rochester (*)
Hamburg Bros., Pittsburgh, Type E-25
Hamburg & Hamburg, Pennsylvania
Hart & Hegemann Mfg. Co., Hartford, H & H
Hartford Metal Products Co. (*)
Harvey-Wells, Southbridge, Mass. 75 Ω
Haynes-Griffin Radio Service (*) see Tested
Holley Mfg. Co., Holleyphone
Holtzer-Cabot
(no city) 2K
No. 4 National (*)
Boston/Chicago (small, early design) 3K
Boston 2K

Boston, No. 2 Universal 1.7K
Holtzer-Cabot Elec. Co., Telephone
Huball (*)
Hubmil TS-5 2K
Henry Hyman & Co., Bestone
H & H - see Hart
Illinois - see Wayland
International Radio Telephone Apparatus Co., New York, De Luxe (*)
Interocean Radio Corp., Jersey City, NJ (*)
IWB (*)
JACO - see Ambrose
Jolley Radio Co., New York (*)
Kellogg 64-C
Kellogg S. & S. [Switchboard & Supply] Co.
(plain)
Chicago, 64-B 2.4K
82-A 200 Ω
85-A (unit)
87-A (unit)
R-14 (U. S. Army) 2K
Colin B. Kennedy
Kennedy
Kennedy 3K
Keystone (*)
Kilbourne-Clark (*)
Kodel Radio Corp., Cincinnati, Quality (*)
Kreigsmarine
Lakeside Electric Works, Chi. Airline Special 2K and 3K
Lark (*) - see Leich
Leich Electric Co., Genoa, Ill., Lark (*)
Lincoln - see Allied
Litewate (*) - see Premier
Little Gem - see Triangle
Little Spitfire, Made in USA
Little Tattler - see Marinette and Tower
M (MESCO)
MacKay Radio 3K
Magnus Electric and Radio Mfg. Corp., New York
Majestic
Manhattan Electrical Supply Co.
MESCO 2500 2K (*)
MESCO 2501 3K
Red Seal 2.5K
Marinette Electric Corp., Blue Streak (*)
Marinette Electric Corp., Marinette, Wisc., Little Tattler (bakelite or alum.) 1.5K (also see Tower)
D. W. May Inc., W B S Phone
A. P. Merchant Co., Boston, Ben Franklin 3K
Meteor 2K (also see Sears Roebuck Co.)
Metro (*) - see Pal
Miller (*)
Monarch Tel. Mfg. Co.
Montgomery Ward, Airline Special
Moretone Radio Co., Chicago, Moretone 3K
Moss-Schury Mfg. Co., Detroit, Repeater 2.4K
Murdock
#55 3K
#56 "1000" and "1500" Special 3K
(watchcase) 100 Ω
Type P-23, CAATC No. 1200
Type R-14, Signal Corps, U. S. Army 1K
Wm. J. Murdock Co.
(plain, two sizes)
H-58/U
HS-16 100 Ω
Chelsea, Mass. (watchcase) 100 Ω
Music Master Co., Phila. (*)
National (*) - see Holtzer-Cabot
Navy Ordnance Supply Co., Navy MIMXXIV 250 Ω
Nerco - see Newark
Newark Eng. and Tool Co., Nerco Phone 2.2K
Neufeld & Kuhnke, Kiel, Germany 6K
Model "D"
Newcomb Audio Products Co., Newcomb 500 Ω
Newton Pressed Steel & Mfg. Co., New-Tone
Newton Pressed Steel & Mfg. Co.
Newton, Mass., Superette 1.5K
New Yorker - see Wayland
N & K - see Goldschmidt
No Name
Pat'd 9/2/1884 75 Ω
Made in France 2K
Made in Germany (stamped in headband)(large nickeled case)
Made in Japan (WW II) 2K
Model 2P 2K
Shaft from band goes through ball on case
The Rex (also see Trimm)
10 A B W/2, metal band with ball socket
No. 29 (black) single
No. 560 single 2K
1000 (nickel) single
Ohio Radio Mfg. Co., Cleve. (*)
Omega
Orator Radio Corp., Washington, DC (*)
NRI, Made Expressly for (single) 1K (also see C. Brandes)
Pacent Electric Co., New York, Everytone 2.2K and 3K (*)
Pal Sales Corp., Jersey City, NJ, Metro (*)
PAL
(nickel-plated)
(brass, painted black)
(trademark) 500 Ω
Peerless - see United
Penberthy Injector Co., Pico Made in Detroit 2.2K 4K (*)
Pennsylvania - see Hamburg
Penn Headset Co. (*)
Perfectone (*) - see Teleradio
Philmore (plain)
Philmore Mfg. Co., New York, Pure-Tone Wonderphone (*)
Pico - see Penberthy
Ports Radio Mfg. Co, Fresno, CA, Prmco (*)
S. A. Potter Tool & Machine Works, New York, Precision
"Precision Phones for Precision Hearing," Chicago 300 Ω
Premier
Premier Electric Co., Chicago, Litewate (*)
Professional - see Trimm
Quality (*) - see Kodel
Racon, New York City, Coherer 33.5K @ 1 kHz
Radio Industries Corp., NY, Rico
Radioceive Mfg. Co., Newark
Radiocraft Hi Power
Radiogem Corp., NYC, "Gemphone" 1K single (*) (wood case, kit)
Radiotive Corp., Brooklyn, Silken Voice (*)
Radio Receptor Co., Type E
Radio Receptor Co., RR Co. Type K
Radio Speakers, Inc.
R-14 2K
Receiver R-16, Signal Corps, U. S. Army
Radio Summit Products Inc.
Radio Supply Co., Hornell, NY, Clarion (*)
Radio Telephone & Telegraph Co., N. Y., Kismet (*)

Randolph Radio Corp., Chicago, Special 3K
RASCO (*)
RCA (single)
RCA 1.5K
Red Head (*) - see Manhattan
Red Seal 2.4K
Repeater - see Moss-Schury
Rex Radio Works, Chi., Excello
The Rex (also see Trimm)
Rheem, Made in Japan 750 Ω
Rico (*) - see Radio Industries
Rico Tripole (also see Tri Pole)
RMCA
Rola ANB H-1
Roller-Smith Co., New York, Universal
Roller-Smith, Universal B 2K
Royal Electrical Laboratories, Newark, Royalfone 2.2K
Royal Electrical Laboratories, Royalfone Special
Roycraft - see Auth
RR Co. - see Radio Receptor
Samson (watch-case) 100 Ω
Schwarze Electric Co., Adrian, MI, 2K and 3K
Scientific Electric Works, The Scientific
Sears Standard Quality 2K
Sears Roebuck and Co.
Meteor
WLS
Seco (*) - see Spielman
Shure Bros., Receiver ANB H-1
Siemens, London (BBC Stamp)
The Smeltzer Co., Browne
Solid
Couch Trademark (also see Clearphone Co.)
Couch Trademark (watch-case)
Pat'd 8/14/1900 3K (single)
(watchcase) 75 Ω
Deveau (watchcase)
Songbird Matched Phones 2.2K
Spartan Electric Corp., NY (*)
Speak-O-Phone
Spielmann Elec. Co., NY, Seco (*)
Splitdorf - see Bethlehem
Sraco (*) - see Standard
Standard Radio Corp., Chicago, Sraco (*)
Standard Electric Mfg. Co., Standard MOD 8
Stanley & Patterson, Gold Seal Radio and Deveau Gold Seal 2.2K and 3.2K
Steinmetz Wireless Mfg. Co., Pittsburgh (*)
Sterling, London
(no BBC stamp)(twin-magnet) 4K
(BBC stamp)(twin-magnet) 2K
(no BBC stamp)(single-magnet) 4K
Stromberg-Carlson
2K
No. 2-A
No. 3-A
Summit Radio Products, Inc., Jersey City
Sunlight Lamp Co., Newton Falls, OH (*)
Superba - English Made (BBC Stamp)
Superette - see Newton
Superfone Elec. Co., Boston, Superfone 3K
Super Electric Co., Super-Fone
Superior Products
Swedish American - see American
Swedish-American Telephone Mfg. Co, Chicago (*)
T. B. H. Radio Co., Dansville, NY
Viodyne (*)
Violana
TBM (*)
Telefunken - EH333
Telephone Bookholder Corp., Dansville, N. Y., T-B-H 2K
Telephonics
50 Ω and 300 Ω
TDH-39
Telephonics Corporation
Type TH-37
Type TH-37A
Teleradio Engineering Corp., N. Y., Perfectone (*)
Tested Radio Products, Inc., New York, Haynes-Griffin
Tempest Prod. Mfg. Co., Indianapolis, Tempest 2.2K
J. S. Timmons
TNC (TMC?)
(BBC stamp)
London, SE 21 (BBC stamp)
Tokyo TK-24 (Made in Japan) 4K
Tokyo Tsushinki KK, Radio Headphone TK-24
Tower Mfg. Corp., Brookline, Mass., Ambassador 3K
Tower Mfg. Corp., Boston
Little Spitfire
Little Tattler (also see Marinette)
Tower Mfg. Corp.
Scientific (variations in metal of case and printing)
Scientific Navy Type (two variations)
Tower
Super Sensitive Navy Type
Super Sensitive (two variations) 3K
Trego 2K
Triangle Electro Trading Co., N. Y.
Berwick Supreme (single 1.1K; dual 2.2K) (also see Electro)
Little Gem
Trimm
(plain)
Acme (single and dual)
Commercial
Dependable (black and nickeled cases)
Featherweight
Featherweight (lorgnette holder) 2K
Professional 2K
Type B
Type K (CTX-49003) 2K
Trimm, Inc., Libertyville, Ill.
Acme 1.5K
Dependable 2K
Trimm, Inc.
Receiver ANB H-1
Receiver CTX-491964
Trimm, Inc., Receiver R-2-A, Signal Corps, U. S. Army (single)
Trimm Radio Mfg. Co.
(large and small bakelite) (black and brown variants) 3K
(single, lorgnette holder)
The Rex (aluminum and black variants) 1K
Trimm Radio Mfg. Co., Chicago
Dependable (*)
Professional (*)
Tri Pole Radio Industries Corporation, RICO
True-Tone Supersensitive 1.5K
True Tone Radio Mfg. Co., Chicago, True Tone 3K (*)
U/S Corp.
Union Fabric Co., Derby, Conn., Ampl-Tone (*)
United Radio Corp., Rochester, NY
Davis (black) 2K
Peerless 2K
(alum.) 2.4K
Universal - see Roller-Smith
Utah
400 Ω
Military 400 Ω
Utah, Chicago, Receiver ANB H-1 225 Ω
Utah Manufacturing Co.

Victor (*) - see American
Victor Radio Mfg. Co., Chi. (*)
Victor Tel. Works
Viodyne - see TBH
Violana - see TBH
Warren Radio Phone Mfg. Co., Inc.
Warren Radio Phone, Warren, R. I., Warren 2K
Warren Radio Phone Mfg. Co., Warren, R. I., Durophone (alum. or black) 2.4K
Wayland Radio Mfg. Co., Wayland, N. Y.
American Bell 2K
The Illinois 1.5K and 2K
The New Yorker
Webster Electric
Weiner - see Wireless
Welbilt (*) - see Friedlander
White Beauty (*)
Wireless Specialty Co., Weiner, Type 2CR
Western Electric
U. S. A.
Pat. Appl'd For 2K
43
45
136 (single)
146-A (single)(watch-case)
186 (single)
194W 2K
400 (single)
509 2.2K
509W (Pat'd 7/23/1918) 2.2K
516W (single) 2.2K
525
528 (single and dual) 50 Ω
528BW 80 Ω
528DW
711A
1002 2.2K (20K at AF) (*)
1010B (*)
ANB H-1 250 Ω
CW-834
CW-49003 2K
P-11 Signal Corps 2K
(Uses HA-2 capsules, 50 and 100 Ω
Wireless Specialty (*)
W. B. S. Phone - see May
WLS Special Headset (variations) (also see Sears)
WLS Special 3K

(Continued from p. 15)

his eminent guest, Dr. Lee de Forest, on their visit to the Lancaster Plant.

Concept, invention and prototyping were the charter of the RCA laboratories, whereas design improvements, product engineering and production were the responsibilities of Lancaster. With the introduction of the color kinescope, there was some exception. The Lancaster Plant performed much of the design concept, innovation and prototype production that were typically done at the laboratories. And even after the demand for increased production was cause to transfer all manufacturing to other plants, Lancaster continued to provide these pre-production functions.

Vidicon camera tubes were invented by RCA and were introduced in 1951. These small tubes, simple in operation, found early acceptance in closed-circuit applications. They continue in common use today but their relatively low sensitivity and poor after-image characteristics often limit the tube to less critical CCTV use. Many companies made their own versions of the vidicon; many even used the name (since RCA failed to register it). New vidicons were introduced, some having new photoconductor materials for improved performance characteristics. One vidicon using the lead-oxide photoconductor was married to then-new solid-state electronics and found almost immediate acceptance in color broadcasting. This new lead-oxide "vidicon" invented and offered by NV Philips of Eindhoven, in the Netherlands, soon replaced the historic image-orthicon. (Ironically, the lead-oxide material was only the earliest evaluated by RCA prior to 1951.) Broadcast cameras could be made much smaller and lighter by using these new vidicons, leading to the still smaller cameras for the new era of electronic journalism. RCA and other companies offered vidicons as small as ⅓" for these new camera systems. The RCA versions used both lead-oxide and selenium photoconductors. (Another irony: selenium was a material evaluated for television even before the first tubes for electronic television. And it, too, was one of the materials investigated by RCA before antimony trisulfide.)

For low-light-level applications, RCA invented the silicon-target vidicon. The tube features a photoconductor consisting of an array of silicon photo-diodes. It is ten times more sensitive than antimony trisulfide vidicons and is the most sensitive vidicon ever developed. It has a spectral response extending from the near ultraviolet to the near infrared. And it can image the sun and exhibit no damage. For extremely low-light-level applications, RCA devised the silicon-intensified-target (SIT) vidicon. This tube uses the accelerated electrons from a photo-cathode to "illuminate" a specially prepared silicon target. The SIT tube will produce full video level from just the light of a moonlit night. The ISIT tube uses an "intensifier" stage ahead of the basic SIT tube and will produce useful video levels from a moonless starlit night.

RCA then combined the technologies of the silicon-diode array and a charge-coupled device in an effort to produce the world's first solid-state imagers. Initial success encouraged efforts and a silicon imaging device (SID) was announced before the end of 1974. It was the first solid-state imager for CCTV. Work continued and, after another decade, the first solid-state imager for color broadcast cameras was announced. It was demonstrated worldwide via the facilities of NBC.

NEW MEMBERS

AWA welcomes the following new members. We list all new members routinely - if your name does not appear within six months, please advise the Editor. If you do not wish to be shown, just mark the application form accordingly. AWA does not provide an address list or other directory of its membership.

Kevin **Adams**, ON; Harry A. **Albright**, FL, W4ZCT; Albert C. **Allen**, Jr., NC, WB4NNC; Larry **Anderson**, WV, general manager, WWVA; Orn **Arnason**, QU; J. L. **Asp**, ONT; Don M. **Baldwin**, NJ; Frederick O. **Barnum** III, NJ, author, His Master's Voice in America; Robert **Bell**, ON; Raymond P. **Bintliff**, K1YDG, MA, RCA; Lewis **Bodkin**, ON; Max **Bodmer**, Switzerland, Bell Labs; Tom **Bond**, NY; Jerry **Bowe**, NY; Donald L. **Brengman**, WA; Ron **Brillinger**, VE3XH, FL; Walter **Britton**, W7MN, OR, maritime radio operator, 35 yrs.; S. C. **Brown**, NC; Wayne D. **Brown**, CA; Joseph M. **Buch**, N2JB, VA, chief engineer, KIOT; Donald **Catton**, IL; Randy **Cole**, KN6W, CA; Michael **Cook**, NJ, Signal Corps, Pacific Bell; David **Cooksey**, MO; Chris **Cuff**, CT; John G. **David**, KB1T, NH, KB1T Radio Specialties ("Ham Photo Calendar"); Joseph J. **DeSousa**, Jr., W1OFK, MA; Michael G. **DeVita**, OH, N8KXY; Joseph **DuLina**, PA; Joe **Edge**, WA4KVI, VA; Gerson G. **Eisenberg**, MD; Charles **Erickson**, NY; Roger **Frank**, CO; Alfred J. **Gianascol**, CA; David **Giovannoni**, MD, Audience Research, NPR; Gerald J. **Glaser**, NY, WA2RHU, Kodak; Jim **Grimes**, KS; Charles L. **Grose**, DE; Arden G. (Tex) **Haller**, NY; William H. B. **Harrison**, W5USP, VA, Defense Communications Agency; Jack **Hart**, MA; Randolph **Haus**, NY; Albert E. **Heine**, LA, W5OVV; Marvin **Hess**, W2WKU, NY, Acme Radio; Wayne L. **Hetrich**, MD, W3OLT, PBS/NPR; Ted **Hewmann**, PA; L. S. **Hicks**, OK; Leonard **Hunter**, PA; Anthony P. **Jacobi**, NE; Bill **Jago**, K7MO, OR; Hardy **James**, LA; Edward G. **Janssen**, Jr., TX; Byron E. **Kalucki**, NY; Edward **Kanterman**, PA; John W. **Keller**, W3NDB, PA, WKOK, WQKX; John **Kendra**, N4LJS, VA; Ralph H. **Klitz**, Sr., PA; Peter A. **Krayer**, NJ; Bill **Kurrasch**, NY; Robert **Kurzawa**, NC; Mr. & Mrs. William **Lawley**, WV; R. D. **Lawrence**, ON; Kwanghoe **Lee**, NY; Ivo **Lemmens**, Holland; Olgierd **Lindan**, OH; Ross **Litrenta**, NY; David **Lum**, NY; Henry A. **Maffeo** II, MA; G. S. **Magraw**, NY; Dan **Manning**, NE; H. David **Maxey**, NC; William D. **McLean**, MI, KB8JIY; Jeff **McLeman**, N1IPN, MA; Gerry **Meekins**, MD; Harvey H. **Mellion**, NY, W2NSV; T. Stephen **Melvin**, CT; Scott & Marie **Merrill**, NY; Stewart **Merson**, NY, RF Communications; Daniel L. **Metzger**, MI, K8JWR, electronics instructor, Monroe College; Victor **Miglietta**, NY; Allen R. **Miller**, KG2V, NJ, broadcast engineer; Richard **Monjure**, LA, N5JOB, ship radio officer; Howard P. **Mortimer**, WB2ZWI, NY; Walter J. **Murphy**, PA; Dr. Harley **Myler**, FL, KC4ZVF; Fred **Newman**, WA8IDI, MI; Carol R. **Olson**, IL; Angelo **Pallotta**, NY, W2TPW; Joseph E. Parker, FL, KC4CFE; Dean **Pearlman**, OH; Eugene L. **Perry**, WI, K9FHJ; Thomas **Petro**, PA; Arthur **Petzon**, NY; Glenn **Piar**, OH; Martin O. **Piepenburg**, W9OLD, IN; Bruno **Pinto**, NY; David A. **Pope**, MA; Larry D. **Porter**, OH; Charles J. **Powers**, MD, NU3N; Gary **Privitera**, NY; Eldon C. **Quick**, K2AIG, NY; Sheridan R. **Rand**, CT; Anthony **Rejman**, NY; Dayle **Roberts**, AR; Brandin **Rockwealth**, NY; Kenneth A. **Roegner**, Jr., WA; Vaughn **Rudisill**, NY, Thrifty Electronic Repair; David I. W. **Russell**, ON; **S & G Electronic**, PA; S. L. **Sandler**, VA, syndicated news/talk show host; Kenneth R. **Schroyer**, PA; Mark A. **Schuckert**, NJ; Mary L. **Seelhorst**, MI; Herbert T. **Segiel**, NY; Keith I. **Siebarth**, MI; James C. **Simak**, K9SRK, IL; Antonio **Simone**, Italy, electronic engineer; Dean **Smith**, MN; Donald **Smith**, MD; Ken W. **Smith**, OR, Ken's Electronics Radio Repair; William L. **Spann**, IN, KA9YKN; Jesse A. **Spilka**, N2HYR, NY, video engineer - cable TV; Mathias N. **Steckl**, NJ, Bogen Communications; Martin **Stonehouse**, ON; Robert J. **Straub**, IL; Gary M. **Stuart**, PA; Jack **Taylor**, VE3DUJ, ON; Wayne **Thalls**, KB6KN, CA, RCA, Indiana State Police; Gary **Tice**, GA; Marvin **Toepfer**, TX; Mark **Twarozek**, NY; Richard **Walsh**, Switzerland; Shigeo **Watanabe**, Japan; Michael **Watts**, NY; W. N. **Watts**, AL; Dr. Art **Weeks**, FL, KC4ZUZ, professor of computer engineering; James A. **Weil**, KE8AP, MI; Paul D. **Wellenkamp**, NY; Harry G. **Wells**, AA6PP, CA; Thomas J. **Wells**, IL; Eugene **Wilbur**, K4FQJ, FL, comm. operator; Thomas A. **Willingham**, K4BEB, GA; Ray **Wilson**, NY; Robert D. **Wilson**, NH; Tim **Yeany**, PA; James M. **Zikes**, KS [Thanks to Joyce Peckham]

HISTORICAL ARTIFACTS

Old-time ads are free to members collecting and restoring equipment for personal use. **The rules:** (1) one ad per issue per member; (2) include an SASE if acknowledgement is desired; (3) material must be over 25 years old and related to electronic communication; (4) give your full name, address, and ZIP code; (5) repeats require another notice - we aren't set up to repeat automatically; (6) the Association is not responsible for **any** transaction; (7) we retain the right to reduce the size of the ad if over seven lines; (8) AWA does not accept commercial advertising; (9) deadline for ads in the May issue is March 11; those received later will be held for the following issue. Mail **all** ads to *(new address)*: **Richard Ransley, Box 41, Sodus, NY 14551.**

SALE/TRADE

Fada Model 106 "Super-Fadalette"; A. Bosch Model 5; Viking 6N2 with 2-meter VFO. Send SASE for list. Leo Vanderpot, 765 N. Broadway, Hastings-on-Hudson, NY 10706, (914) 478-4092.

Magazines: Selling off large collection of *Radio News* and *Radio Craft*. Send for magazine listing. Also have Crosley Trirdyn Special (3-tube reflex), untried, with both audios OK. Excellent to mint, $145. RCA Radiola 20, works, in good to excellent cond., $135. Ron Boucher, PO Box 541M, Goffstown, NH 03045, (603) 497-2988.

Old-time radio shows on tape cassettes. Catalog listing nearly 5000 shows arranged by category and title, $2. Earstwhile Radio, PO Box 2284, Peabody, MA 01960.

Knobs: custom-made molded plastic. Send knob to be duplicated plus $8 money order. Custom-made plastic dial lenses. Send old lens if possible, tracing of lens opening, make and model of radio and $15 money order. L. W. Terrell, 7109 E. Arbor Ave., Mesa, AZ 85208, (602) 830-7849.

Iconoscope: Trade early TV iconoscope tube for vintage broadcast microphone on my "wanted" list. Write for details. James Steele, Box 620, Kingsland, GA 3154.8

Baird **stock certificates**, 1930s (John Baird invented mechanical scanner, see Nov. '88 *OTB*), $55; Collins Radio certificate $10; Admiral Radio, $10; Sentinel, $10; Western Union, $10. J. J. Papovich, 53 Magnolia Ave., Pitman, NJ 08071.

Morse operators: Exact repros of the **Bunnell "Acme" resonator**. Hoods avail. in wine red, WU green, gray and natural (varnished), pedestals black with felt base and 4-foot cord, $45 incl. UPS. No CODs. Jack Proefrock, K6QEQ, 20814 S. Hawaiian Ave., Lakewood, CA 90715.

Scarce Motorola (automotive) **shortwave converter** Model SW3-12 in orig. box. Tunes 4.5-16 MHz, 800 kHz output. Works on +12VDC. Has 12AT7 tube. Makes any BC set into SW. Makes TRF into a superhet. Works good., $40 firm, including packing and UPS. Jim & Nadiene Farago, 4017 42 Ave. So., Minneapolis, MN 55406-3528, (612) 722-0708. Call before visiting.

Free verbal **appraisal** of your vintage television, call most weekdays before 7 PM or send photo and SASE. I'm buying early and small transistors for upcoming book. Harry Poster, Box 1883, South Hackensack, NJ 07606, (201) 794-9606.

Ham call books, 1953 $10; 1970 and 76 both for $12; *Electronics* mags 1941 to 49, random copies, $2.50 ea.; *Electronics* Buyers Guides 1953 to 59, random copies, $5 each plus shipping. Frank Krantz, 100 Osage Ave., Somerdale, NJ 08083.

A-, B- and C-batteries for your 1920s receivers. A-batts are standard No. 6 dry cells, 1-½ V, $3 ea.; B-batts are 45 V with tap at 22-½, $5 ea.; C-batts are 4-½ V, $5 ea. All have binding posts. Checked and guaranteed. Add $2 per order plus 50 cents per batt. for shipping. Also have tubes. SASE for list. Victor Smith, 147-29 Hoover Ave., Briarwood, NY 11435, (718) 523-7059.

Grille cloth for 1930s radios. Top-quality reproduction cloth in eight original patterns available - as good as the cloth first used in these sets. Send LSASE for actual cloth samples. Additional patterns on order. Michael Katz, 432 Park Avenue South #402, New York, NY 10016.

ARRL Handbooks; Federal audio transformer; Sea Shell horn (replica); Scottie Radio (bookcase style); Crosley "Big Dial" 66TW table model; AK 708 cathedral; Airline V1 (1935) velocity microphone; AK playing cards; Ovenshire Labs horn speaker; *National Radio News* (bound) 1930-1939. Floyd Paul, 1545 Raymond Ave., Glendale, CA 91201, (818) 242-8961.

Tubes: thinning supply. New tubes under market price. Send wants and large SASE for partial list. Pete Langlo, 373 N. Kellogg Ave., Santa Barbara, CA 93111, (805) 964-6512 after 5 PM.

Shifting gears - Have **Hammarlund HQ-180A**, military R-388/URR by Collins; Sony 230B; looking for good quality cathedrals. Phil Harris, 711 E. 44th St., Savannah, GA, (912) 356-5338.

Galaxy III with pair of new finals $65; 1976 U. S. Amateur Callbook in fair condition $2; antique radio lightning arrester $3. James Looney, WB4RBE, Rt. 1, Box, 54, Grundy, VA 24614.

Thordarson power transformer 24R105, new in box, 115-V pri, 60 VCT at 2500 mA DC, 6.3 V at 1.5 A, 6.3 V at 1.5 A. $15 plus 10 lbs UPS. John Uscinowski, RR #2, Box 379, Greenwich, NY 12834-9519.

Military surplus, magazines, manuals, books, tubes, misc. old parts, ham items. SASE for list. Hart York, 17356 Miller, Fontana, CA 92336, (714) 822-5993.

Zenith G503Y 1950s portable w/flip-up dial, $45; Airline 94BR1535 1950 deco bakelite, $45; Masters Art tube wall phone novelty, $65; RCA WV-98A VTVM, $25. SASE for picture list of more clean wkg radios. Rod Galloway, 2220 Woodbury Rd., Melbourne, FL 32935, (407) 254-0280.

Stromberg-Carlson frequency converter 24 VDC to 22, 44, etc., Hz; patent 1909; nice oak & glass case $295. Radiola 28 w/base $140. Ken Blakeman, RD #3, Fulton, NY 13069, (315) 678-2252.

AK 20 VG-exc. cond., $90; *QST* Vol. LIV No. 1-12, $25 for all; Philco floor model 46-1226, non-working, $30; all plus shipping or pickup. Have for trade - manual for Tek 564 scope for a 561 manual. Kwanghoe Lee, 150 W. Village Pl. #321, Ithaca, NY 14850.

Heathkit IT-10 transistor-diode checker; Heath IP-18 1-15 V reg. power supply; B & K FP-3 Dyna-flex 3-point xstr test probe. All, with manuals, for $20 total incl. postage. Ken Greenberg, 4858 Lee, Skokie, IL 60077, (708) 679-8641.

Weston meters 3/30 amps w/ext. shunt #14475 and a 75, 600 VDC #1240. Pictured in Lighting a Revolution from the Smithsonian Institution. Excellent cond. Make offer. Edward Kerns, 4009 Fauquier Ave., Richmond, VA 23227.

WANTED

Small knobs with slot for record player & radio-phono controls of Zenith 6RO87. Power pack & record changer on mtg board (16½ x 13) for RCA Victor VE-9-16X 1850. Brass bezel around dial of Grunow 568. Speaker for Clarion Jr., AC-60. Larry Porter, 4115 Beam Rd., Crestline, OH 44827, (419) 683-2540.

Nixie tubes (tubes that display numbers or letters). How many types are there? Does anyone have any tech data? I would like to get as many different types as possible. Will buy or trade a great schematic for a Nixie-tube clock I designed. Nixie clock schematic available alone for $10. Leonard J. Arzoomanian, 61 Columbus Ave., North Providence, RI, (401) 232-0869.

Broadcast-band command set, BC-946 or Navy R-24/ARC-5. Also console radio, late 30s or early 40s. Hallicrafters SX-71. George Stringe, 3075 Moorhead, Boulder, CO 8030.3

Radio set BC-474 (SCR-288), a small WW II transceiver, complete set or parts. Especially need filter FL-10 and the CW key which has a knurled thumbscrew on the front left corner of the key to secure to lid of set. Henry Engstrom, PO Box 5846, Santa Rosa, CA 95402.

Ship receiver AR-8510 or R-215. Walter Britton, 225 S. 17th St., St. Helens, OR 97051.

Radar equipment - units or complete systems. Need parts for SCR-584 search radar. Also need 5J26 magnetron tubes. Al Weiner, 14 Prospect Drive, Yonkers, NY 10705, (914) 423-6638.

Riders Vols. 20, 22 and 23; *Electronics Illustrated*, June 1961; manual for Eico 379 sine/sq. wave gen.; McMurdo Silver 801, 801 band coils. Al Bernard, PO Box 690098, Orlando, FL 32819, (407) 351-5536.

Crosley audio xfmr as used in Model 50-51 series. Open-circuit windings OK. Need schematic for Ameco VFO, Model VFO-621. Collector of WE Co. items - tubes, components, receivers, amps, literature. Tad Dragoski, N3JZQ, 507 Coal Valley Rd., Jefferson Boro, PA 15025.

Restorable Zenith big black-dial and shutter-dial table radios, chassis and cabinets. Any condition. Basket cases OK. James Fisher, 344 Harrison Ave., Manville, NJ 08835, (908) 725-7476.

WE tubes: a Japanese amateur still wishes to purchase your surplus genuine Western Electric tubes - 205D/E (qty. 2), 205F (qty. 2) and 264C (qty. 4). Must have good g_m. Please quote. TKS VE5HF! Would like to know of any shops dealing in WE items in USA or Canada. Jun Yatsuyanagi, JH8SST/7, 1-7 Hinai-machi, Araya, Akita, 010-16 Japan.

AK crystal set (replica), galvanometers (pre-1920), clock cathedrals, celluloid horn and WW I spark outfit. Have for sale WW I wavemeter, receptor & Boulder early superhets, medical quack and others. Mel Rosenthal, 5 The Strand, New Castle, DE 19720.

Philmore crystal sets and any Philmore catalogs from the 1920s and 1930s. Please state price and condition. Phillip Drexler, 1175 E. Ripley Ave., St. Paul, MN 55109, (612) 771-8630.

Federal Jr. crystal set and any other factory-made xtal set, also crystal radio kits. Please make offer with your price and if possible include photo. Many thanks! Erwin Macho, Ambrosweg 17/A/8, A-1230 Vienna, Austria.

Crystal set parts, detectors, variable condensers, variometers, variocouplers, headsets, switches, tap points, binding posts, etc. B. Turke, 660 N. Dixie Highway, Hollywood, FL 33020.

Magazines: *Radio Today* and *Radio Retailing*. I will buy or have lots of duplicates to trade. Doug Heimstead, 1349 Hillcrest Dr., Fridley, MN 55432, (612) 571-1387.

Crank-style phonographs, horns and related parts. Also want to buy cathedral and tombstone radios and Nipper things such as ashtrays, signs, etc. Also any Victor and Edison advertising. Bernie Seinberg, K3RSW, 801 Sand Wedge Ct., Warrington, PA 18976, (215) 343-7743.

Citizens Radio Call Book magazine for 1920 thru 26; Dept. of Commerce Amateur Radio Call Books for 1924, 25, 27; Dept. of Commerce Radio Stations of the U. S. for 1913, 14, 15; Dept. of Commerce Commercial and Govt. Radio Stations of the U. S. 1922 thru 28; Radio Amateur Call Book Magazine (flying-horse cover) for 1926, 35 and 36. Bob Arrowsmith, PO Box 166, Annandale, VA 22003, (703) 560-7161 collect.

Original radio and speaker for 1948 Crosley car (also others, parts) wanted. John Wilson, RR1, Box 81M, Stoddard, WI 54658.

OTB Vol. 1 No. 1 needed to complete my OTB collection. Your help greatly appreciated. Jim Clark, 1292 Starboard, Okemos, MI 48864.

OTB Vol. 19 #2. Crosley 59 chassis. Greg Dockter, 414 Browning Ave., Bismarck, ND 58501.

Manual for Eico 667; manual for TV-7; tech manual for BC-348J, N and Q; *CQ* 1942 to 1945; *QST* Dec. 1942; CQ Anthology 1, 2. Alan Mark, PO Box 372, Pembroke, MA 02359.

A History of Science and Engineering in the Bell System, The Early Years, 1875-1925; schematic/-service for Boonton Radio 240-A sweep signal generator. Steve Dow, RR3, Zilinsky Road, Powell River, BC, Canada V8A 5CI.

Repair manual and circuit diagrams for 1948 True Tone Model D1176; D1145 Ser. 6A50 radio-phono; also a Philco Model 48-1253 radio-phono. Dial drum for RCA Model 18. Mark Twarozek, 11760 Mile Block Rd., North Collins, NY 14111.

Lysco AM-CW, VFO & crystal controlled transmitter (35 watt input) wanted. James Alcorn, K2CAB, 122 Illinois St., Rochester, NY 14609.

Power supply for Atwater Kent Model 40. Steve Kalista, HC-1, Box 137, Jim Thorpe, PA 18229, (717) 325-4120.

Bakelite panel: 1/8 inch, 12 x 18; manual or copy on Weston OQ-2 tube checker; pix or info on BC-11-A aircraft rcvr; Western Electric amplifiers, receivers, tubes, literature and microphones. Marc Ingenthron, 9748 Outlook, Overland Park, KS 66207.

Copy of World's Equivalent Tubes (Vade Mecum) by Brans. Gary Cain, 1775 Grand #302, St. Paul, MN 55105, (612) 698-4851.

2nd or 3rd **IF transformer** for AR-88D (*OTB* 5-91); matching spkr for same, will buy junker; Hallicrafters SP-44; knobs for GE M-81 (*OTB* 8-91); Riders Vol. 23 + Index for Vols. 15, 19-23; escutcheon for 70; cabinet for SP-600. Tony Ellis, 17 Odeon Ct., Baltimore, MD 21234, (301) 882-6190.

Transistor radios made in America or Japan. Will buy or trade. Eric Wrobbel, 20802 Exhibit Court, Woodland Hills, CA 91367.

New member needs complete set of **tubes and speaker** for AK 70 chassis; also need tubes from 30s and 40s and tele-dial for Fairbanks-Morse 9AC. Any help much appreciated. Greg Carlson, 1075 Washington Ave. S. #8A, Bemidji, MN 56601, (218) 751-3077.

Audio transformers and bakelite chassis panel for de Forest F-5. Cabinet and speaker for Philco 20 and 90. Have several cathedral speakers, $25 each, and several headphones at $15 each. Don Sturzenbecher, Rt. 3 Box 28, Sioux Falls, SD 57106, (605) 368-2135.

HELP! Need **schematic**, picture or parts layout for my REL All Wave Amateur Rcvr, 10-200 meters. Any help will be deeply appreciated. Harold Spaulding, 1567 Lilac Way, Upland, CA 91786.

Collins 32V-3 transmitter and 20 or 30, 26A6, 26A7 tubes. Fenton Wood, 109 Shoreline Dr., S.H., Malakoff, TX 75148.

Westinghouse RT antenna coupler and AR RF amplifier. Ian L. Sanders, 16725 Wild Oak Way, Morgan Hill, CA 95037, (408) 778-7547.

Early **Paragon receivers**, Grebe CR-18, Pilot Super Wasp. Paul Christensen, N9AZ, 11142 Raley Creek South, Jacksonville, FL 32225, (904) 721-9111 before 5 PM.

Pilot Super Wasp and Grebe CR-18. State price and condition. Willing to consider junkers. Also willing to consider trade for my early radio sets. Joseph B. Kelber, KB8GLD, 287 S. Williams St. #B, Newark, OH, (614) 345-7407.

Power xfmr for Knight R-C Tester 83Y124 w/sec'y voltages of 6.3, 60 and 500. Majestic

chassis 151 (Havenwood) or 153 (Ellswood). Cabinet and spkr for Philco 40-155. Crosley chassis 148. Variable condenser for Philips B4X26A. All chasses should be working in restorable cond. Also want info on Philips farm set BX328B/S3 Nr L14576E. Carlos Martinez,#21 Colonel Irizarry St., Cayey, PR 00736, (809) 263-2741.

For local museum display - "nonfunctional" WD-11 tubes (duds!) as well as a balanced amplifier for the Radiola III. Orn Arnason, Box 207, Knowlton, Quebec, Canada J0E 1V0.

Tobe Model H and Tobe-Browning 35 manuals or copies, for these shortwave receiver kits. John Kelly, 19133 Stedwick Dr., Gaithersburg, MD 20879, (301) 977-0596.

Power xfmr for AK 84; *CQ* for Sept. 1956, Feb., March and April 1959; Hallicrafters S-39, S-72, R-80; and 4-, 5- & 6-pin prewound plug-in coils. Richard LaMark, 6822 Tuckahoe Road, Williamson, NY 14589, (315) 589-2552.

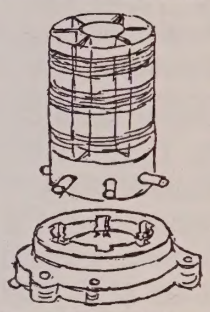
Any **info** on 2-tube regenerative radio called "The Jewett Parkay" radio cabinet. Will pay for drawings, history, etc. Terry Browning, PO Box 1, Goodwater, AL 35072, (205) 839-5921.

Radio mag. of Jan 1935 with McElroy article (Part 1) in it; Mac-Key with brass nameplate; book History of Communications-Electronics in the U.S. Navy by Howeth, 1963. Tom French, W1IMQ, 120 Great Road, Maynard, MA 01754.

Short Wave Craft magazine, 1930-1935. Condition unimportant as long as legible. Only the content is of interest (not as a collectable). For student use, so cost is important. C. F. Rockey, W9SCH, Box 171, Albany, WI 53502.

Scott: Desire to contact anyone who worked for, knows of, or knows of someone associated with E. H. Scott Radio Laboratories of Chicago. I am attempting to preserve the history of this company and your help is appreciated. Scott radios from 1925-48 and amps in any cond. wanted. Literature also pursued. John Meredith, 1792 Nemoke Trail, Haslett, MI 48840, (517) 349-4348.

REL (Radio Eng. Labs.) **coils** or forms & matching socket. Socket is 3-3/4" OD; coil form is 2" OD, 4" high, with radial pins. Ref.: *QST*, Feb. 1929, p. 69. Bill Fizette, K3ZJW, RD 1, Box 55, Henryville, PA 18332, (717) 629-0637.



AND BOOK MAGAZINE REVIEWS

Edited by Bruce Kelley

PERIODICALS

MODERN RADIO DRAMA

A quarterly covering radio plays, both past and present. A recent issue listed program times for radio plays on most U. S. - Canadian AM and FM stations. Good copy for the radio-listening buff. Subscription: $10, to Modern Radio Drama, Box 12631, Berkeley, CA 94701. - BK

CATALOGS

VINTAGE WIRELESS CO., LTD. VALVE CATALOGUE - 1992

£3.00 postpaid for foreign purchasers (£2.00 in Britain), refunded with first purchase, from Vintage Wireless Company, Tudor House, Cossham St., Mangotsfield, Bristol BS17 3EN, England, (0272) 565472 (Fax [0272] 575442). This remarkable listing, issued in addition to the regular equipment and book listings from this seller, occupies 45 pages. It offers sockets, cartons, several pages of books on tubes (including charts of ratings and equivalent types), and a raft of new tubes: British commercial, British military (CV-types), U. S., European, German Army, etc., totaling about 3300 types. Special deals on used tubes are also offered, as with KT88s for stereos. There are several pages of "tube lore": the coding systems used in British and Continental tube numbers to indicate basic ratings.

This firm claims, believably, to have 2,000,000 + tubes in stock. For us foreign buyers, they take American Express, Mastercard, and Visa; thereby getting out of currency-conversion hassles. - LAS

1992 WHOLESALE CATALOG

Antique Electronic Supply, 6221 S. Maple Ave, Tempe, AZ 85283, (602) 820-5411; fax (602) 820-4643. This is the latest issue of the catalog that is "basic training" in what's available in repair-restoration supplies. The biggest feature is the tube stock: about 3000 types, including Western Electric, industrial, foreign, and transmitting types, plus true antique versions. The rest of the catalog is 18 pages of parts (need a power transformer with 2.5-volt heater winding? a B-battery? a repro Philco dial? wooden knobs? a BBC decal?) and a book section expanded to eight pages. I've been buying from this source for five-plus years and gotten good results each time. - LAS

1991-92 RADIO CATALOG

Vintage TV and Radio Supply, 3498 W. 105th St., Cleveland, OH 44111; (216) 671-6712, fax (216) 251-1617. This new listing gives 19 pages of restoration supplies, grill cloth, Magnavox decals, dial pointers, lacquers, books, etc. There is a

whole page of original-style knobs, and custom knob-molding service is offered. About 1800 receiving tubes are listed. - LAS

BOOKS

COMMUNICATIONS RECEIVERS
THE VACUUM TUBE ERA: 1932-1981

By Raymond S. Moore. Second ed., softbound, 8-½" x 11" format, 115 pp., 375 illus., $17.95 plus $2.50 handling in U. S. and Canada, from RSM Communications, PO Box 218, Norwood, MA 02062; or from Antique Electronic Supply.

The first edition of this handy reference has been available since 1987. I've used it numerous times to check details on receivers and their makers, finding it quite helpful. The new edition expands the book slightly page-wise, adding details on both famous and obscure brands, plus numerous additional illustrations. Each set is outlined concisely: the year, original price, frequency coverage, IF, filter method, tube lineup, and any special remarks. Essentially every receiver is illustrated. For the major manufacturers, a crisp history gives the origin and fate of the company. There are some truly rare brands - Barrett, Boulevard, General Manufacturing, Guthman, Karadio, etc., as well as the makers that are household words. Histories of Hallicrafters, Patterson, McMurdo Silver, and E. M. Sargent contain new information.

I'm not claiming that this is a masterpiece of typography. The pictures are of xerographic quality, and there are small goofs here and there in the text. But the book is fun to leaf through and valuable as a reference, and quite affordable.

RSM Communications also offers monographs on three Hallicrafters sets: the DD-1 (14 pp., $4.95 postpaid; the S-1 (four pp., $2.00, and the Echophone EC-2 (two pp., $2.00). - LAS

EMPIRE OF THE AIR
THE MEN WHO MADE RADIO

By Tom Lewis. Hardbound, 421 pp., 87 illus., $24.95, Edward Burlingame Books (Harper Collins), available from local general bookstores and (at least) Vestal Press [PO Box 97, Vestal, NY 13851-0097, (607) 797-4872; fax (607) 797-4898], Antique Electronic Supply, and Antique Radio Classified [PO Box 2, Carlisle, MA 01741, (508) 371-0512; fax (508) 371-7129].

This biographical study examines the lives of Lee de Forest, David Sarnoff, and Edwin Armstrong against the background of radio technology and the "empire" of RCA. It gives a character profile of each and, for the first time, provides an integrated view of the interactions (some friendly, most bitterly hostile) among the three. We have de Forest, the vain, self-obsessed inventor and one-time stock jobber; Sarnoff, the immigrant boy driven to success in the corporate world; and Armstrong, the brilliant and headstrong researcher. The fruits of their lives are well known: the vacuum tube, radio broadcasting, television, etc. Armstrong also devised the regenerative, superregenerative, and superheterodyne receivers and, his masterpiece, FM. Lewis' coverage of the court battles that stripped Armstrong of his regeneration patent is coherent and informative. The result is an insightful and satisfying presentation. The "movie version," the Ken Burns/PBS video, draws from the same extensive research sources as made the book possible - including appreciable material from AWA.

I have always been a little leery of books on technology written by non-technologists. The author makes some galling mistakes of fact. His description of radio-wave propagation on p. 52 is vivid but inaccurate: "[t]he electrons liberated by Marconi's spark gap transformer imperceptibly traveled through the air at the speed of light." We are told (p. 242) that de Forest's company made "all Atwater Kent radios." Armstrong's FM demonstration to the IRE (p. 266) gave a "signal to noise ratio of 100 to 1" (20 dB? 40 dB? 100 dB?). British readers will be surprised to hear (p. 37) that the Post Office still controls telephone communication in England (after several years of Mercury Communications and the privatization of British Telecom). They may be *astonished* to read that the Luftwaffe was detected in the Battle of Britain by "ear and sight stations along the coast" and that "electronics [radar] began to take over" only later. IFF systems are claimed (p. 287) to have used superregenerative receivers (superhets!). Echoing the over-enthusiasm for FM of Armstrong's biographer Lawrence Lessing, the Navy's TBS "talk between ships" AM radio becomes an FM system (p. 283). The Signal Corps moon radar of 1946 (p. 297) turns into an FM device, which is fantasy - it was a conventional pulse radar. Armstrong's tropospheric-propagation experiment of 1947, we are told on p. 306, yielded "domestic microwave relay stations capable of handling television and telephone traffic over distances far greater than the limits of a horizon" - in theory, but never used (or usable) in the U. S. because of the horrific spectrum-coordination problems and shaky economics.

These goofs, although unfortunate and unnecessary, can be forgiven in the overall context of the book. This work is enjoyable reading. It is a landmark, comparable to H. G. J. Aitken's books in depth but much more readable. - LAS

"HIS MASTER'S VOICE" IN AMERICA

By Fred Barnum, 388 pp, 8- x 11" format, hardbound, from General Electric Aerospace, Bldg. 10-4, Delaware and Cooper Sts.., Camden, NJ 08102, (609) 338-4718. Price $36 plus sales tax applicable to purchaser's locale, i. e., $38.52 for NJ residents.

This 90-year photo history covers the Victor

Talking Machine Company, the Radio Corporation of America, and the General Electric Company; with special emphasis on their operations in Camden. Its strong point is illustrations: about 700 photos from such sources as the Hall of History Foundation in Schenectady. Topics covered include the history of the phonograph, the "Nipper" trademark, Victor up to its acquisition by RCA, the Radio Corporation itself, and GE as successor to (and liquidator of) RCA.

This is a corporate-sponsored effort admittedly intended to "invoke feelings of pride, nostalgia, and motivation in the hearts of current and former employees . . ." The great pitfall of official histories is that they tend to cover up the warts, giving us the company as it would like to be seen rather than arms'-length history.

As a result, we are told (p. 130) the tattered RCA promo story of the young David Sarnoff, single-handedly receiving the distress signals of the *Titanic* directly in New York; of President Taft ordering all other stations off the air so the young hero could hear better; of Sarnoff sticking to his key for 72 hours straight, etc. [Tom Lewis' book demolishes this fable nicely.] The Radiola 20, 25, and 28 become "the first sets adaptable to . . . AC" operation; the Radiola 17 becomes "the first fully AC-operated set using AC tubes." [T'ain't necessarily so.] The material on RCA Photophone makes no hint at deadly competition with Western Electric in the "talkies" area. The "Pioneering in FM" section makes no mention of Armstrong, but does tell us that RCA's W2XWG was the first FM station "in" New York. (Armstrong's W2XMN was six months earlier, but was about 12,000 feet *outside* the city!) We are told that "RCA radar equipment was the only radar equipment in use by the Navy when the US entered World War II." Inspiring, but the first of 20 WE Mark I and III radars was in service on the USS Wichita in July 1941. The SC radar from *GE* (!) seems to have been prewar also. We are informed (p. 193) that Irving Wolff of RCA invented the radar altimeter in 1937 - despite patents on such devices held by other researchers in the early 1930s.

Despite the biased view, there is fresh and meritorious material; the coverage of military equipment development, for example, is informative and hard to find elsewhere. The book is handsomely bound and hefty. It represents good value, particularly for the photos. - LAS

RADIO MANUFACTURERS OF THE 1920s, Vol. 3

By Alan Douglas. 285 pp., 8-½ x 11 format, softbound, $29.95, from (at least) the publisher Vestal Press; ARC; AES; or the ARCA Museum Bookstore, 4704 Country Club Blvd., So. Charleston, WV 25309. (Hardbound, $39.95 from the first three).

Well, it's now here: the conclusion of the series. Douglas has done his usual fine work, providing carefully researched, well-written text; high-quality photos of sample receivers; selected ads and promotional material; and general background exhibits on 21 makers - from small (Thorola) to huge (RCA, Zenith). Inclusion of obscure makers provides an insight to the tumultuous nature of the Twenties radio industry that would be missed by covering only the "biggies." This volume also provides an index to firms and individuals covered in all three volumes, making it a biographical source as well as corporate history.

There are some surprises here. RCA's early marketing strategy comes across as rather confused and bumbling, compared to more nimble competitors like AK. It appears that the origins of Hallicrafters receivers can be traced back, via Echophone, to The Radio Shop of Sunnyvale, Calif., a tiny "Silicon Valley start-up" from 1920. There is an interesting portrayal of Western Electric as a would-be receiver maker - more than broadcast stations and Bell System supplies.

The first two volumes are still available. For the record, here is the coverage that they afford. **Vol. 1** addresses A-C Dayton, Adams-Morgan, Air-Way, All-American Mohawk, American Bosch, Amrad, Apex, Atwater Kent, Bremer-Tully, Browning-Drake, Clapp-Eastham, Crosley, Cutting & Washington, Day-Fan, De Forest, Eagle, ERLA, Fada, Federal, and Ferguson. **Vol. 2** includes Freed-Eisemann, Eisemann, Freshman, Garod, Gilfillan, Grebe, Howard, Jones, Kellogg, Kennedy, King, Kodel, Kolster, Leutz, Magnavox, Majestic, Marti, Metro, Klitzen, Midwest, Mu-Rad, Murdock, Music Master, Neutrowound, Operadio, Ozarka, Pfanstiehl, Philco, Pilot, and Priess. **Vol. 3** covers RCA, Scott, Silver-Marshall, Slagle, Sleeper, Sonora, Sparton, Splitdorf, Steinite, Stewart-Warner, Stromberg-Carlson, Thermiodyne, R. E. Thompson, Thorola, Tri-City, Tuska, Ware, Western Coil, WE, Workrite, and Zenith.

These volumes, totaling almost 2" in thickness, are now a standard reference in their field. - LAS

NOT READ BUT AVAILABLE:

IN THE SHADOW OF THE SHIELD - THE DEVELOPMENT OF WIRELESS TELEGRAPHY AND RADIO BROADCASTING IN KINGSTON AND AT QUEEN'S UNIVERSITY: AN ORAL AND DOCUMENTARY HISTORY, 1902-57

By Arthur E. Zimmerman. 658 pages, illustrated, hardcover, $29.95 Canadian (GST included). Available from the author at 204-670 Sir John A. MacDonald Blvd., Kingston, Ontario K7M 1A3, (613) 542-1789.

The book documents early wireless demonstrations: the first in Canada (1897); first in the U. S. (1897, by a Canadian); and first in Kingston,

at Queen's (1902). It covers a Queen's M. Sc. thesis, "Wireless Communication" (1910); formal teaching of wireless telegraphy at Queen's (1912); the world's first wireless time signals (1907); radio training at Barriefield War Camp (1915-17); reconstructions of three early Queen's wireless sets (1911-19); Queen's Wireless Club, founded 1919; experimental station 9BT (1922); oral and documentary history of CFRC (1923-57); broadcast of the Roosevelt Convocation to the U. S. networks (1938); the Student Radio club operating CFRC (1945-); Prof. Stewart's FM experiments, VE9BH (1943-53); Kingston Collegiate radio boys (1913); fads in equipment; DXing; the Monarch Battery station CFMC (1925-27); the Marconi Great Lakes wireless chain; history and equipment of VBH, Barriefield Heights; Ernest Rutherford's wireless experiments at McGill (1899-1902); and origins of Marconi's XWA, Montreal (c. 1915) - among other topics.

MUSEUM NEWS

MOTOROLA MUSEUM OPEN

The Motorola Museum of Electronics opened in September, in the corporate complex at Schaumburg, IL (1297 E. Algonquin Rd. at Meacham Rd.). It is housed in a building with 50-foot vaulted ceiling and 20,000 sq. ft. of exhibition space, with a 220-seat auditorium. Exhibits include the history of the company ("Radio Reigns, 1928-48," "Electronics and the Good Life, 1947-74," "Revolution in Miniature, 1949-74," and current technology (flexible/robotic manufacturing, radio communications, microelectronics, the "intelligent vehicle," cellular telecomm, and a "simulated exploration of electronic knowledge." Visitors begin with an eight-minute video, and can take an "audio tour" if desired, in English, Japanese, or Spanish.

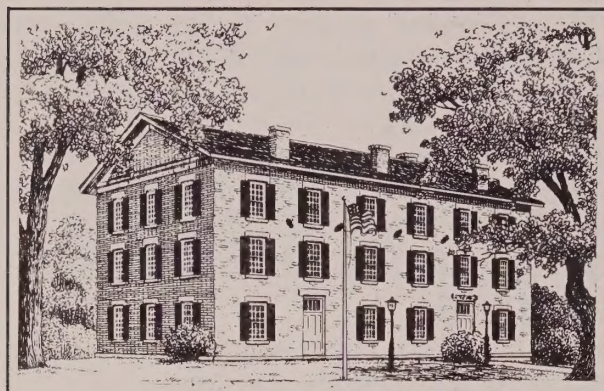
Historical material naturally follows the evolution of Motorola, from battery eliminators to car radios, home sets, police and other land-mobile equipment, the SCR-536 AM handie-talkie and SCR-300 FM walkie-talkie, television sets, cellular phones, chips, etc. As with many modern museums, there is a strong emphasis on user-participation displays.

The museum, an extension of the Motorola corporate education center, is open to the public, free, 9:00-4:30 on weekdays except holidays and the last two weeks in December. Group tours can be arranged by calling (708) 576-8620. There is also a corporate research archive, accessible by appointment.

This looks like an effective and informative facility. Thanks to Sharon Darling of the Museum for source material. Reports of a visitor's impressions would be welcome. - LAS

Photo: Motorola

THE MUSEUM



AWA ELECTRONIC COMMUNICATION MUSEUM

Location: Village Green, Rtes. 5 & 20, East Bloomfield, New York
Hours: May 1 through October 31: Sunday, 2-5 PM; June 1 - August 31: Saturday, 2-4 PM; Wednesday, 7-9 PM. (Closed Holidays)
Group tours by appointment: 716-657-7489
Museum telephone: 716-657-6260
Amateur Station: W2AN
FREE ADMISSION

1992 MUSEUM ACTIVITY

Recent visitors have seen the effect of the highlighting of displays, accomplished by blocking windows and using spotlights. 1992 will find several new exhibits which will benefit from the improved lighting.

Fred Linn, W9NZF, has provided a Morse decoder which activates a sounder in the Western Union telegraph office. By pushing a button, visitors will be able to hear landline Morse signals on a sounder as recorded on a tape cassette. Mani Pires has placed an oscilloscope in operation, to the delight of young visitors who can now "see" their voices on a screen, while Chuck Bliley has the 3" Pilot TV set working in conjunction with the Jenkins and Baird Nipkow-disc sets.

A recent acquisition is the working iconoscope TV camera which Ross Smith built in 1940 from a *QST* article. It won a prize in the Equipment Contest at the 1989 Conference and is pictured on p. 9 of the November 1989 *OTB*. It may be the centerpiece of a future exhibit. This and other material is being conditioned in the Museum Annex. Lastly, in the making is a slide show titled "Treasures in the AWA Museum." It will replace an earlier version, now outdated, and will be available for club meetings.

Do you live in the Rochester (NY) area? Would you like to volunteer as a museum guide? Contact the curator, (716) 657-7489, or registrar Chuck Bliley (716) 334-2904 for details.

NEW MATERIAL OR OTHER DONATIONS

Ed Barry, WB2AMC; Bill Brooker, W4WZU; Craig Clark, NX1G; Bill Collins, N4KPV; A. Dreher, W2TKG; Dave Geiser, WB2ANU; Marie Johnston; Fred Linn, W9NZF; Joe Meyer, W2VW; Herb Morgan; Wm. Plumpe; Wilson Norwood, W2IQQ; Mani Pires; Tony Prasil; Mary Jane Rubenstein, KA2FGE; Norm Smith; Ross Smith; Fin Stewart; Adolph Uryniak, W2UT; John Vanderpool; Vestal Press; Leon Wagemaker; Norris Wemett; Robert & Tina Wiepert; John Weyers.

MONETARY DONATIONS

Additional donations have been received in memory of pioneer Ed Stiles, W2BJW, and from Bell Communications Research, Inc. The Museum Committee appreciates this kind of gift, which goes into an account providing funds for museum utility and insurance costs as well as new displays. All gifts are tax-deductible. Large donations receive special attention. Write for information.

Left: Assistant Curator Henry O'Meara (in cap) showing the Museum's TV display during the Conference.

Ransley photo